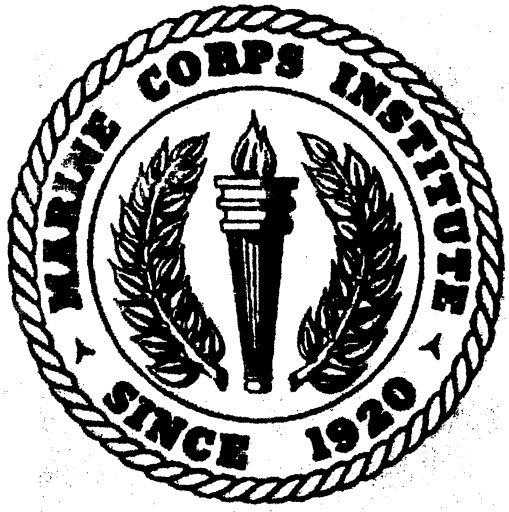
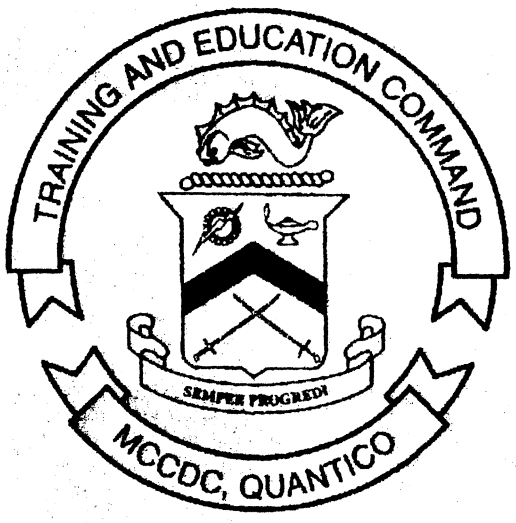
MCI 0321A

MARINE CORPS INSTITUTE





THE M240G MACHINEGUNNER

MARINE BARRACKS
WASHINGTON, DC

UNITED STATES MARINE CORPS
MARINE CORPS INSTITUTE
WASHINGTON NAVY YARD
912 POOR STREET, S E
WASHINGTON, DC 20391-5680

IN REPLY REFER TO:

03.21a
1 Aug 97

MCI 03.21a THE M240G MACHINEGUNNER

1. Purpose. This course, MCI 03.21a, The M240G Machinegunner, has been published to provide instruction to all Marines. During their military careers, it is highly probable that all Marines will become members of a defensive force and will be required to function as M240G machinegunners.

2. Scope. MCI 03.21a addresses both fundamental and advanced principles of employing the M240G machinegun in tactical situations, including the following: basic marksmanship; offensive employment; defensive employment; night/low visibility marksmanship; and engaging moving targets, including antiair defense. MCI 03.21a covers all individual training standards (ITSs) pertaining to the M240G from duty areas 1 and 2 of MOS 0331, found in MCO 1510.35c, dated 5 Jan 95.

3. Applicability. This course is intended for instructional purposes only. It is designed for use by all Marines who are machinegunners by MOS, who may be required to perform duties as a machinegunner, and who are leaders of machinegunners.

4. Recommendations. Comments and recommendations on the contents of this course are invited and will aid in subsequent course revisions. Please complete the course evaluation questionnaire at the end of this text and return it to:

Director (CDD-2)
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G. WHITE
Lieutenant Colonel, U.S. Marine Corps
Deputy Director

THE M240G MACHINEGUNNER

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Student Information

Number and Title	MCI 0321A THE M240G MACHINEGUNNER
Study Hours	10
Course Materials	Text
Review Agency	The Basic School Quantico, VA
Reserve Retirement Credits (RRC)	3
ACE	Not applicable to civilian training/education
Assistance	For administrative assistance, have your training officer or NCO log on to the MCI home page at www.mci.usmc.mil. Marines CONUS may call toll free 1-800-MCI-USMC. Marines worldwide may call commercial (202) 685-7596 or DSN 325-7596.

Study Guide

Congratulations

Congratulations on your enrollment in a distance education course from the Distance Learning and Technologies Department (DLTD) of the Marine Corps Institute (MCI). Since 1920, the Marine Corps Institute has been helping tens of thousands of hard-charging Marines, like you, improve their technical job performance skills through distance learning. By enrolling in this course, you have shown a desire to improve the skills you have and master new skills to enhance your job performance. The distance learning course you have chosen, MCI 0321A, *The M240G Machinegunner,* contains five study units. The first study unit is an introduction, the second discusses operation of the M240G machinegun, the third presents general techniques of fire, the fourth covers engaging targets, and the fifth study unit is about employing the machinegun.

Your Personal Characteristics

- **YOU ARE PROPERLY MOTIVATED.** You have made a positive decision to get training on your own. Self-motivation is perhaps the most important force in learning or achieving anything. Doing whatever is necessary to learn is motivation. You have it!

- **YOU SEEK TO IMPROVE YOURSELF.** You are enrolled to improve those skills you already possess, and to learn new skills. When you improve yourself, you improve the Corps!

- **YOU HAVE THE INITIATIVE TO ACT.** By acting on your own, you have shown you are a self-starter, willing to reach out for opportunities to learn and grow.

- **YOU ACCEPT CHALLENGES.** You have self-confidence and believe in your ability to acquire knowledge and skills. You have the self-confidence to set goals and the ability to achieve them, enabling you to meet every challenge.

- **YOU ARE ABLE TO SET AND ACCOMPLISH PRACTICAL GOALS.** You are willing to commit time, effort, and the resources necessary to set and accomplish your goals. These professional traits will help you successfully complete this distance learning course.

Continued on next page

Study Guide, Continued

Beginning Your Course

Before you actually begin this course of study, read the student information page. If you find any course materials missing, notify your training officer or training NCO. If you have all the required materials, you are ready to begin.

To begin your course of study, familiarize yourself with the structure of the course text. One way to do this is to read the table of contents. Notice the table of contents covers specific areas of study and the order in which they are presented. You will find the text divided into several study units. Each study unit is comprised of two or more lessons, lesson exercises, and finally, a study unit exercise.

Leafing Through the Text

Leaf through the text and look at the course. Read a few lesson exercise questions to get an idea of the type of material in the course. If the course has additional study aids, such as a handbook or plotting board, familiarize yourself with them.

The First Study Unit

Turn to the first page of study unit 1. On this page, you will find an introduction to the study unit and generally the first study unit lesson. Study unit lessons contain learning objectives, lesson text, and exercises.

Reading the Learning Objectives

Learning objectives describe in concise terms what the successful learner, you, will be able to do as a result of mastering the content of the lesson text. Read the objectives for each lesson and then read the lesson text. As you read the lesson text, make notes on the points you feel are important.

Completing the Exercises

To determine your mastery of the learning objectives and text, complete the exercises developed for you. Exercises are located at the end of each lesson, and at the end of each study unit. Without referring to the text, complete the exercise questions and then check your responses against those provided.

Continued on next page

Continuing to March

Continue on to the next lesson, repeating the above process until you have completed all lessons in the study unit. Follow the same procedures for each study unit in the course.

Preparing for the Final Exam

To prepare for your final exam, you must review what you learned in the course. The following suggestions will help make the review interesting and challenging.

- **CHALLENGE YOURSELF.** Try to recall the entire learning sequence without referring to the text. Can you do it? Now look back at the text to see if you have left anything out. This review should be interesting. Undoubtedly, you'll find you were not able to recall everything. But with a little effort, you'll be able to recall a great deal of the information.

- **USE UNUSED MINUTES.** Use your spare moments to review. Read your notes or a part of a study unit, rework exercise items, review again; you can do many of these things during the unused minutes of every day.

- **APPLY WHAT YOU HAVE LEARNED.** It is always best to use the skill or knowledge you've learned as soon as possible. If it isn't possible to actually use the skill or knowledge, at least try to imagine a situation in which you would apply this learning. For example make up and solve your own problems. Or, better still, make up and solve problems that use most of the elements of a study unit.

- **USE THE "SHAKEDOWN CRUISE" TECHNIQUE.** Ask another Marine to lend a hand by asking you questions about the course. Choose a particular study unit and let your buddy "fire away." This technique can be interesting and challenging for both of you!

- **MAKE REVIEWS FUN AND BENEFICIAL.** Reviews are good habits that enhance learning. They don't have to be long and tedious. In fact, some learners find short reviews conducted more often prove more beneficial.

Continued on next page

Tackling the Final Exam

When you have completed your study of the course material and are confident with the results attained on your study unit exercises, take the sealed envelope marked **"FINAL EXAM"** to your unit training NCO or training officer. Your training NCO or officer will administer the final examination and return the examination and the answer sheet to MCI for grading. Before taking your final examination, read the directions on the DP-37 answer sheet carefully.

Completing Your Course

The sooner you complete your course, the sooner you can better yourself by applying what you've learned! HOWEVER--you do have 2 years from the date of enrollment to complete this course.

Graduating!

As a graduate of this distance education course and as a dedicated Marine, your job performance skills will improve, benefiting you, your unit, and the Marine Corps.

Semper Fidelis!

STUDY UNIT 1

INTRODUCTION TO THE M240G MACHINEGUN

Introduction. Place: Guadalcanal. Time: 25 Oct 1942. As the Marines are being hammered by the Japanese, a machinegun section leader named Sergeant Basilone fights valiantly against the enemy's determined assault. In a fierce frontal attack, the Japanese knock one machinegun section out of action. Sergeant Basilone bravely mans an extra machinegun and gallantly holds his position until replacements arrived. He was awarded the Medal of Honor for unselfish bravery in the face of almost certain defeat and death.

Do you know why Sergeant Basilone was effective? Because he knew the limits of his machinegun. Could you be as effective? In this study unit, you will learn about the M240G--its characteristics and nomenclature, how to assemble and disassemble it, and its proper maintenance.

Lesson 1. IDENTIFYING THE CHARACTERISTICS OF THE M240G MACHINEGUN

LEARNING OBJECTIVES

1. Identify the four descriptive characteristics of the M240G machinegun.
2. Select from a list the correct general data of the M240G machinegun.
3. Identify the correct nomenclature for selected parts (major components) of the M240G machinegun by labeling them on an illustration.
4. Identify the characteristics of the sights on the M240G machinegun.
5. Identify the correct nomenclature for selected parts of the M240G 's spare barrel carrying case.
6. Identify the five types of ammunition used for the M240G machinegun.

1101. Descriptive Characteristics

The M240G machinegun has the following four descriptive characteristics:

- Belt-fed
- Air-cooled
- Gas-operated
- Fully automatic

The M240G fires from an open-bolt position, fed by a disintegrating belt of metal links. You can fire the M240G from a pedestal, a bipod, or a tripod mount. The M240G has a quick-change barrel with a fixed headspace. This feature allows rapid cooling, which extends the life of each barrel and accounts for the M240G's high sustained rate of fire.

?	Do you remember the four descriptive characteristics of the M240G machinegun? Did you answer "air-cooled, belt-fed, gas-operated, and fully automatic"? You are correct!

1102. General Characteristics on the M240G

Table 1-1 lists the general characteristics of the M240G machinegun. As you employ the M240G, use this chart as a quick reference to look up your M240G's capabilities.

Table 1-1. M240 Machinegun General Data

CHARACTERISTICS	DESCRIPTION/CAPABILITY
WEIGHT	
Machinegun (all 5 major components)	Approximately 24.2 pounds
Barrel group assembly (with flash hider, front sight, carrying handle, and gas regulator)	Approximately 6.6 pounds
M122 Tripod Mount	Approximately 15 pounds
OVERALL LENGTH OF THE GUN	Approximately 49 inches
RIFLING	4 grooves with uniform right-hand twist (1 turn per 12")
LIMITS OF TRAVERSE (USING M122 TRIPOD AND T&E MECHANISM)	
Using traversing bar	875 mils (49 degrees)
Free gun	6400 mils (360 degrees)
LIMITS OF ELEVATION	
Using M122 tripod and T&E mechanism	247 mils (14 degrees)
Free Gun	996 mils (56 degrees)
RATES OF FIRE	
Cyclic	650-950 rounds/minute (depends on gas setting) on continious burst
Sustained	100 rounds/minute; 6-8 round burst (4-5 seconds between bursts) (Change barrel every 10 minutes)
Rapid	200 rounds/minute; 10-12 round burst (2-3 seconds between bursts) (Change barrel every 2 minutes)
RANGE	
Maximum	3725 meters
Maximum effective	1800 meters with M122 tripod and T&E mechanism
Tracer burnout	Approximately 900 meters
Grazing fire	600 meters

1103. The Major Components of the M240G

Figure 1-1 illustrates the major components that make up the M240G. The name of each component is provided below the figure.

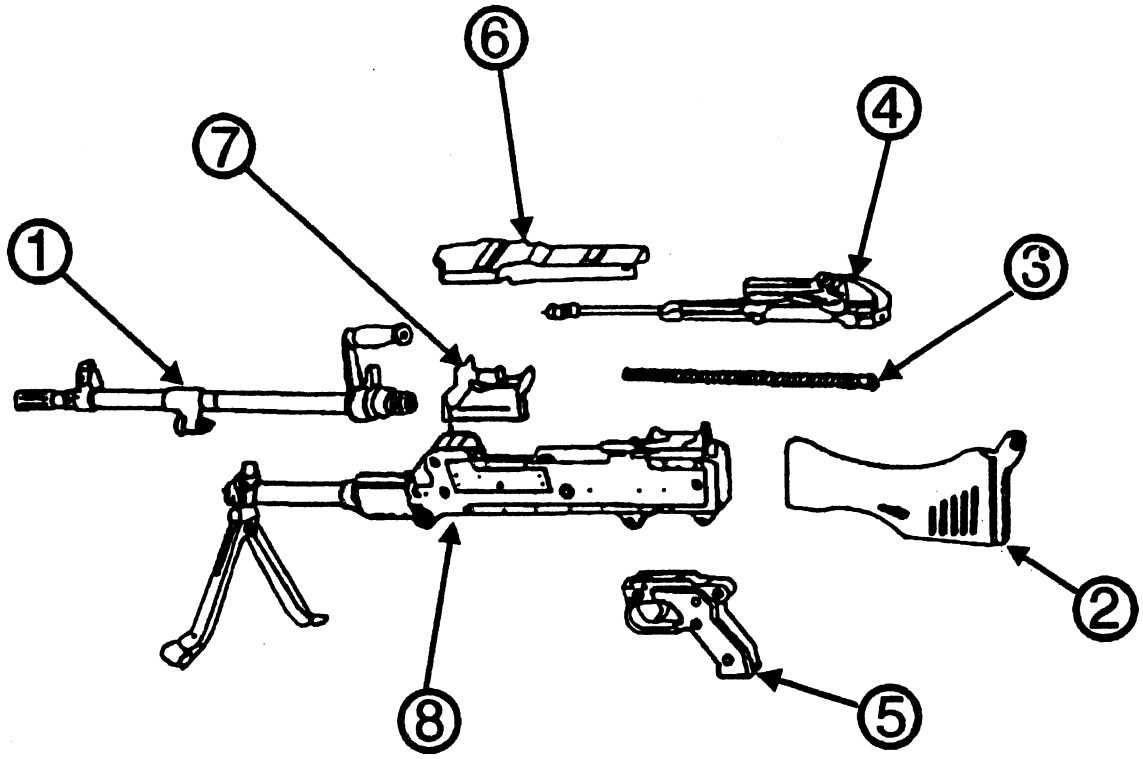


Fig 1-1. Major components of the M240G.

Listed below are the names of the eight major components of the M240G. The number of the component corresponds to number in the illustration above.

Illustration #	Name of Component
(1)	Barrel group assembly
(2)	Buttstock and buffer assembly
(3)	Drive spring rod assembly
(4)	Bolt and operating rod assembly
(5)	Trigger housing assembly
(6)	Cover assembly
(7)	Feed tray
(8)	Receiver assembly

1104. Characteristics of the Front and Rear Sights

a. Front sight. Your M240G machinegun has two sights attached to it (similar to the M16A2). The front sight is attached to the barrel; it is fully adjustable for both elevation and windage by the operator.

(1) Elevation. You can change the elevation by using the combination front sight adjusting tool (see fig 1-2). This tool serves two purposes--one end unlocks the front sight blade retaining strap, and the other end turns the front sight blade for elevation changes with its special slotted end piece.

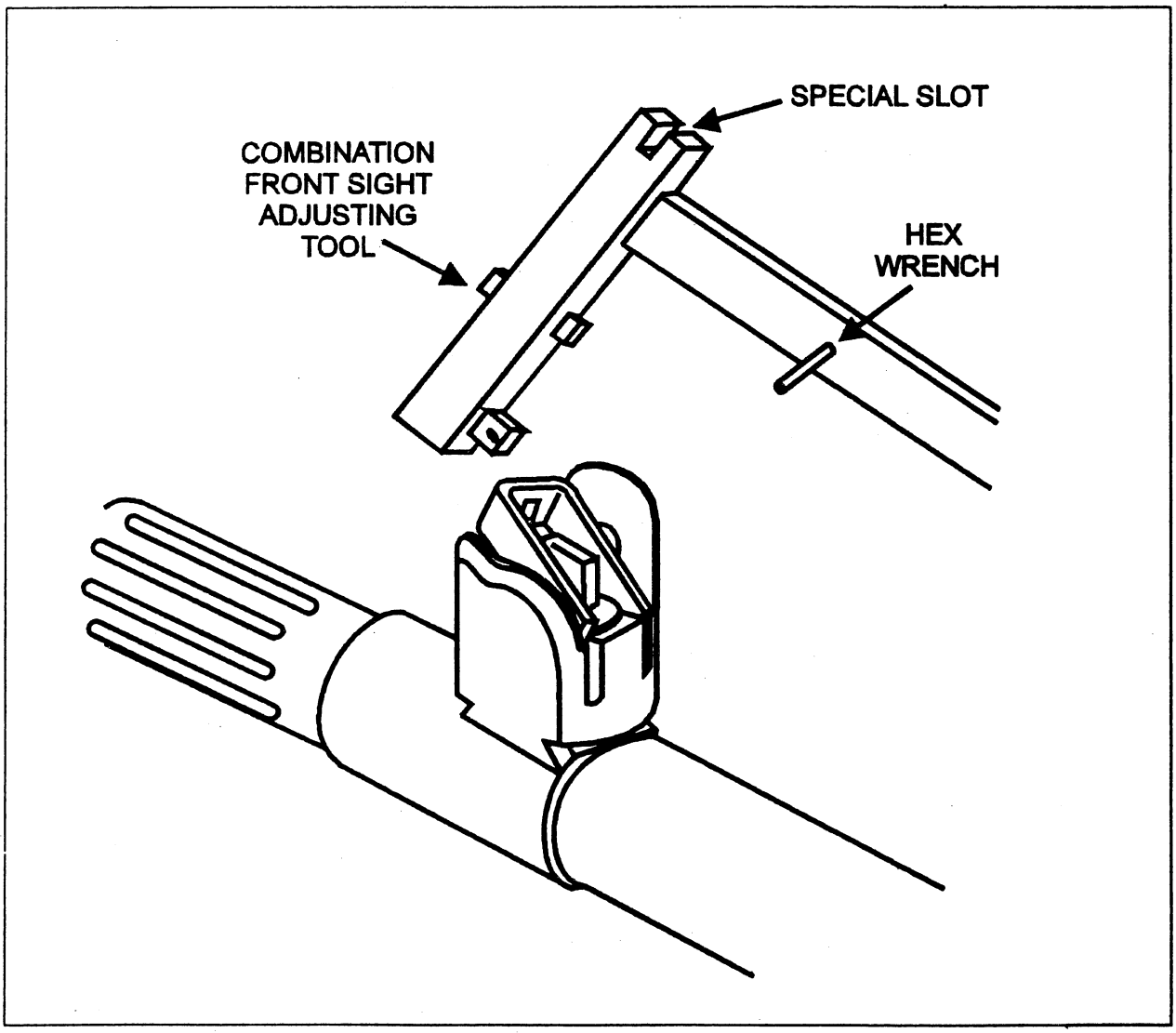


Fig 1-2. View of the combination front sight adjusting tool unlocking the front sight blade retaining strap.

(2) Windage. You can change the windage by using the hex wrench on the combination front sight adjusting tool. If the tool does not tightly fit the socket heads of the windage adjustment screws, use any other hex wrench of proper size (see fig 1-3).

Warning: ALWAYS loosen, then tighten the windage screws.

Note: If you move one windage screw three clicks, you must move the other screw the same number of clicks in the opposite direction. Do not tighten the windage screws too much because these screws break easily.

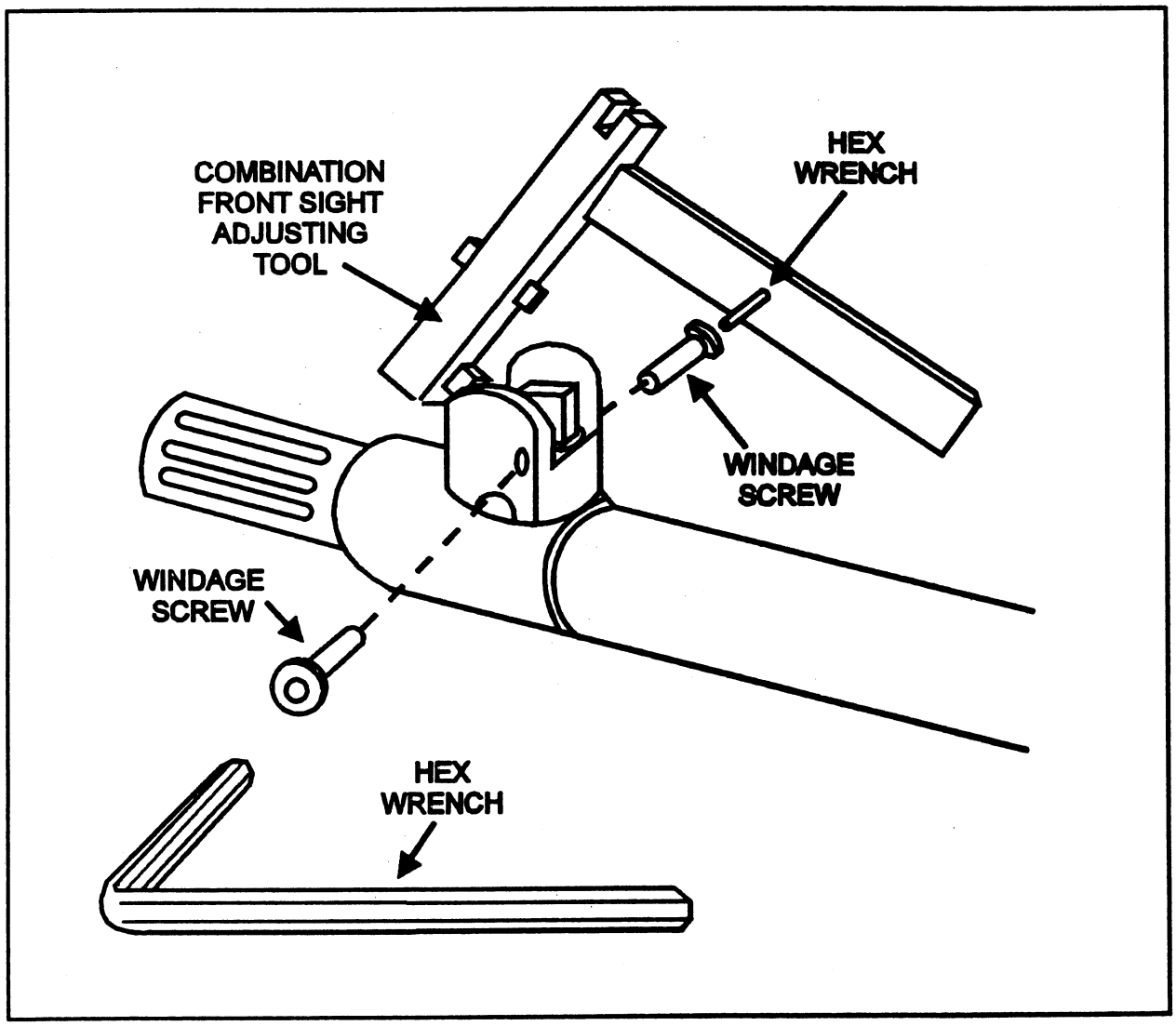


Fig 1-3. Changing windage with socket head screw.

b. Rear sight. The rear sight consists of a peep-sight aperture on an adjustable sight-leaf slide. The sight-leaf slide rides on a range plate with a graduated scale that is attached to the weapon by a hinged mount. You will normally carry the gun with the sight in the horizontal (down) position. You can use the gun with the sight in this position to engage targets at a distance of 800 meters or less. You must raise the gun to engage targets at a distance of more than 800 meters. You will see that the range plate scale, which is located on both sides of the range plate, is marked at 100 meter intervals. This scale begins at 200 meters and continues to the maximum effective range of 1800 meters. You can make range changes by moving the rear sight slide horizontally along its graduated steps for range settings from 200 to 800 meters. For ranges beyond 800 up to 1800 meters, you must raise the sight to its upright position (fig 1-4).

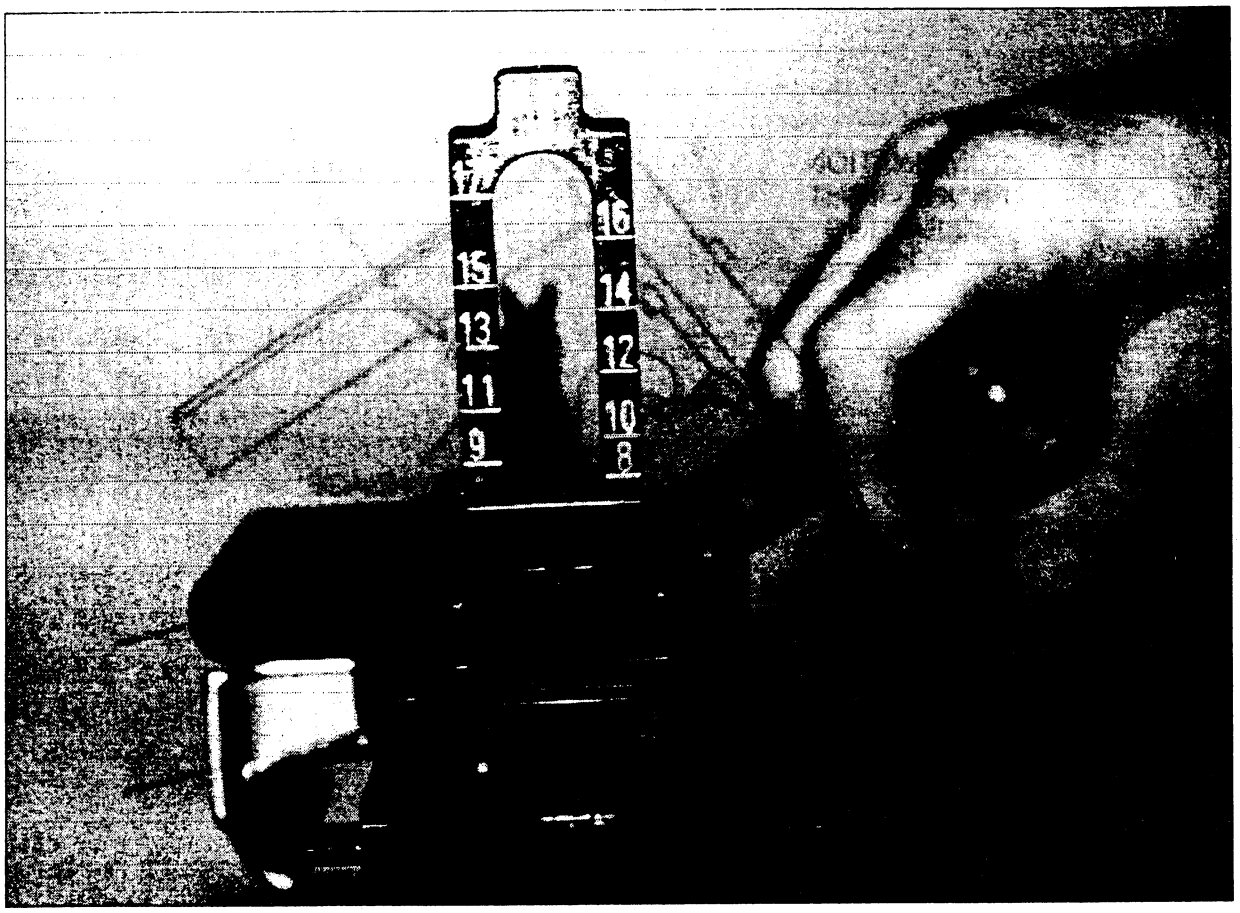


Fig 1-4. Rear sight in the upright position.

?	Are you learning? Which sight can be adjusted for windage and elevation? Did you say "the front sight"? Great! Now proceed to the next part of the lesson where we will discuss spare barrel equipment.

1105. Spare Barrel Carrying Case Equipment for the M240G Machinegun

Just as with most weapons systems, the Marine Corps assigns you additional equipment to help you operate and properly maintain the M240G. Figure 1-5 shows the components that go into the spare barrel carrying case of the M240G machinegun. The Marine Corps refers to these components as "SL3 gear."

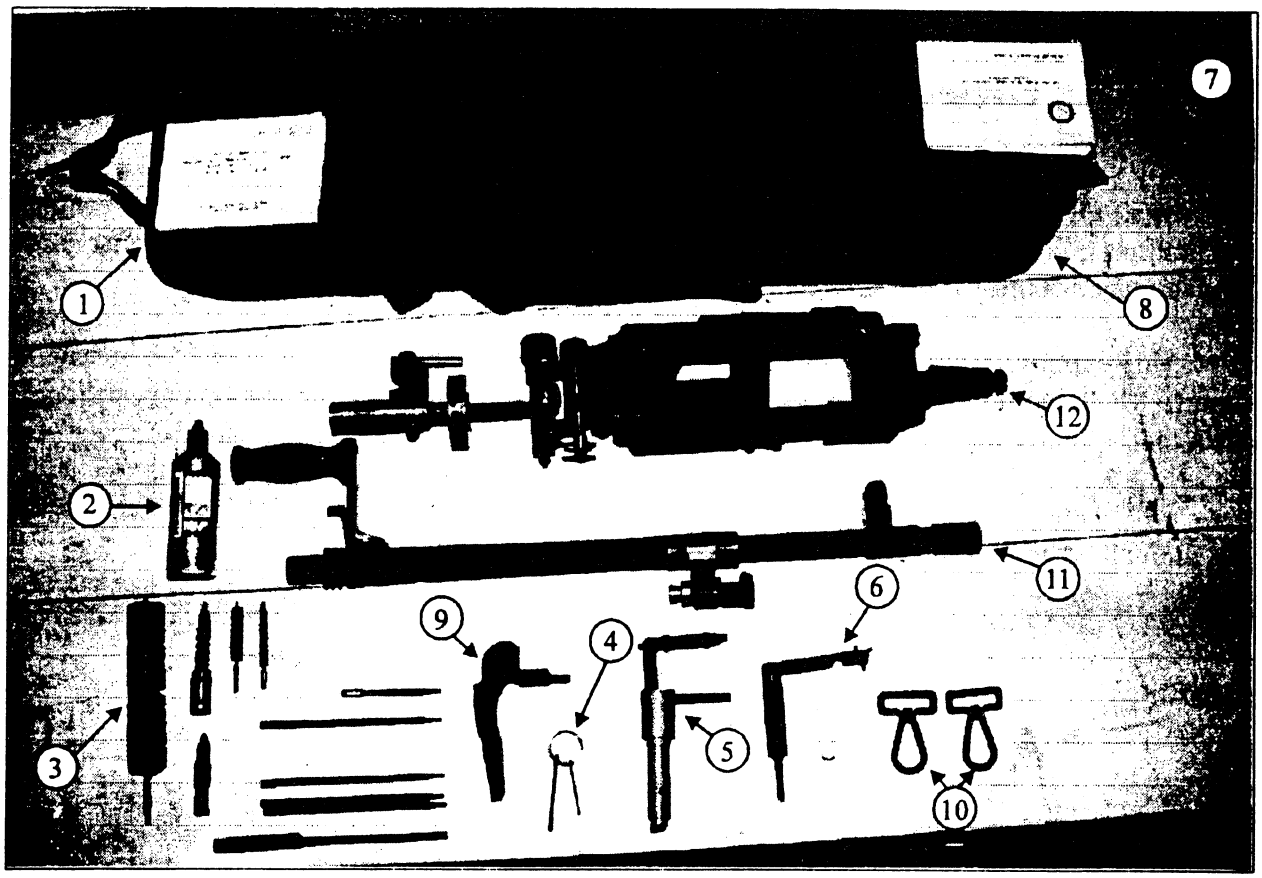


Fig 1-5. Spare barrel carrying case and equipment.

1. TM 08670B-10/1
2. CLP bottle
3. Cleaning brushes and cleaning rods
4. Cleaning reamer
5. Combination scraper and extractor
6. Combination regulator scraper
7. TM (Marine Corps) 08670A-10/1A
8. Spare barrel carrying case
9. Ruptured cartridge extractor
10. Sling keepers
11. Spare barrel
12. Flex mount with traversing and elevation (T&E) mechanism

1106. Ammunition for the M240G Machinegun

Listed below are the five types of ammunition used in the M240G. See figure 1-6 for illustrations of this ammunition.

a. M61 armor-piercing (AP). Use this ammunition to engage light armored vehicles. AP is capable of penetrating up to 7mm of steel at 300 meters or 5mm of steel at 500 meters. You can identify an AP round by its black tip.

b. M80 ball. Use this ammunition to engage all types of targets. You can identify an M80 ball by its plain bullet tip.

c. M62 tracer. Use this ammunition to assist the gunner in engaging targets during the night and at times of limited visibility. Tracer rounds are mixed with ball rounds in a 4:1 combat mix. You can identify the tracer round by its orange tip.

d. M63 dummy. Use this ammunition to train loading and unloading procedures. You can identify M63 dummy ammunition by its six longitudinal corrugations (flutings) on the cartridge. Also, there is no primer or vent hole in the prime pocket.

e. M82 blank. Use this ammunition for training. You can identify the M82 blank because it has a double-tapered neck and no bullet.

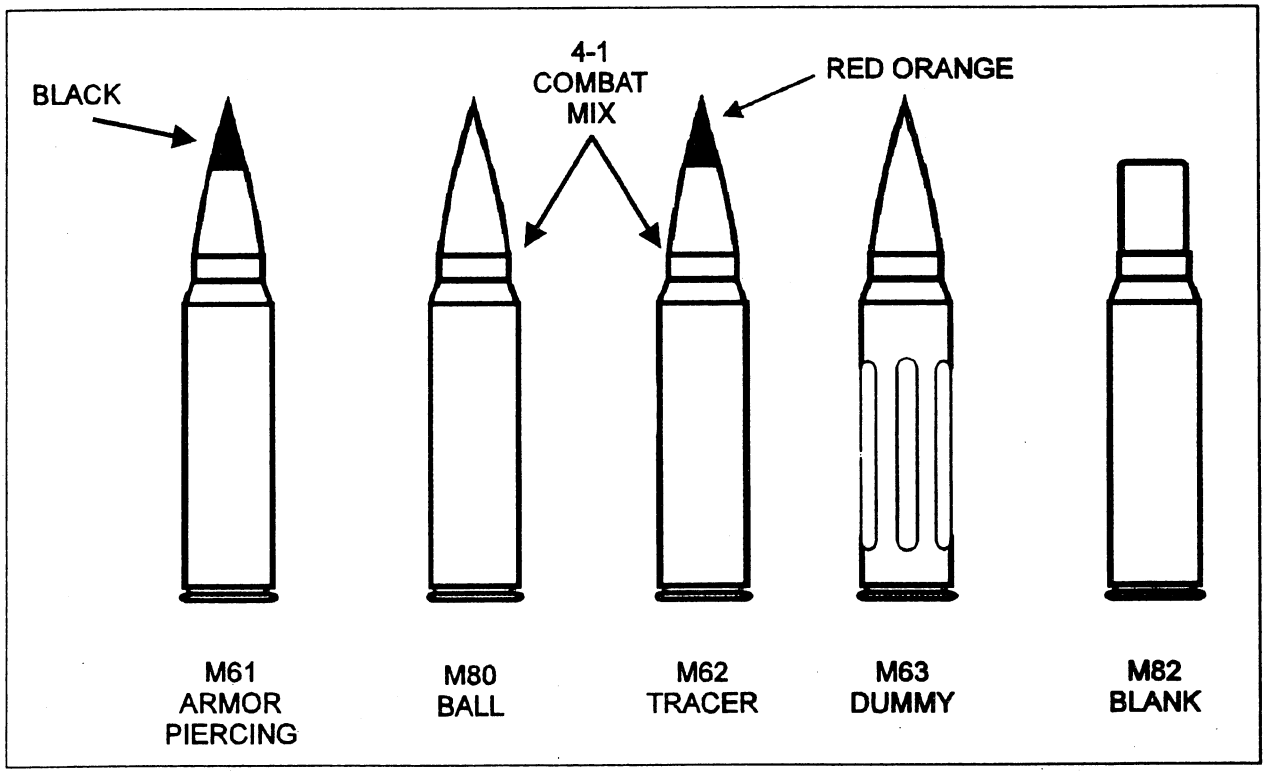


Fig 1-6. Ammunition for M240G machinegun.

Lesson Summary. In this lesson, we covered many aspects of the M240G machinegun, including its characteristics, sights, general data, and ammunition. In the next lesson, we will further explore the M240G, providing information on how to clear, field-strip, disassemble, and maintain this machinegun.

Lesson 2. CLEARING, FIELD-STRIPPPING, DETAILED DISASSEMBLING/ ASSEMBLING, AND MAINTAINING THE M240G

LEARNING OBJECTIVES

1. Select the correct sequence for the steps used to clear the M240G machinegun.
2. Select the correct sequence for the steps used to field-strip the M240G machinegun.
3. Select the correct steps to disassemble in detail the M240G machinegun.
4. Select the correct steps for mounting the M240G machinegun on the M122 tripod.
5. Select the correct procedures for maintaining the M240G machinegun.

1201. Disassembly Method for the M240G

You can disassemble and assemble the M240G without using force. As you remove parts, place them in the order of disassembly on a poncho or similar item. By doing this, you prevent the loss of parts and you make reassembly much easier. Since the parts are arranged in the order of disassembly, you can simply reassemble them in the reverse order.

1202. Clearing the M240G Machinegun

a. First! Ensure Safe handling of weapon. Before you do anything with any weapon, you must ensure that the weapon is safe to handle. Accidental shootings are usually caused by a "supposedly" safe or unloaded weapon. Such accidents are often called "negligent discharges" because somebody was irresponsible or careless. When it comes to weapons, negligence can easily lead to tragedy.

b. Steps for clearing the M240G. To clear your M240G machinegun, the first action you take is to point the weapon in a safe direction. Then, in the order given, follow the steps that follow:

(1) Place weapon safety on "F" (for fire) (see fig 1-7).

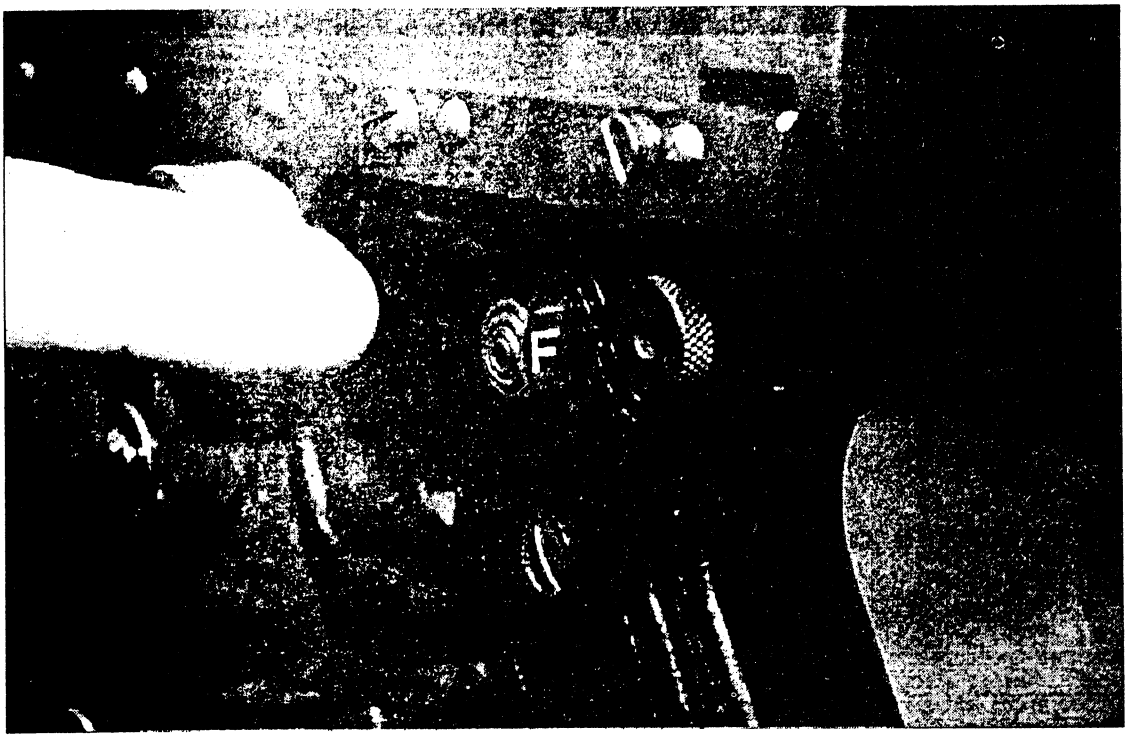


Fig 1-7. Safety on "F."

(2) Pull cocking handle to rear to lock bolt back (see fig 1-8); then push the handle all the way forward.

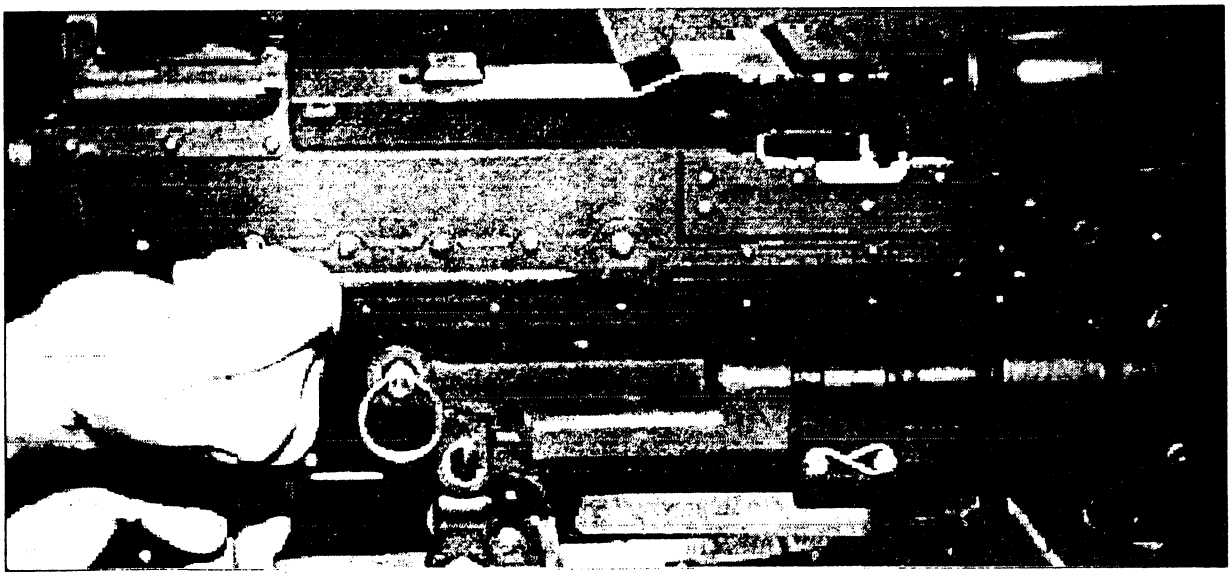


Fig 1-8. Pulling cocking handle to rear.

(3) Place weapon safety on "S" (for safe) (see fig 1-9).

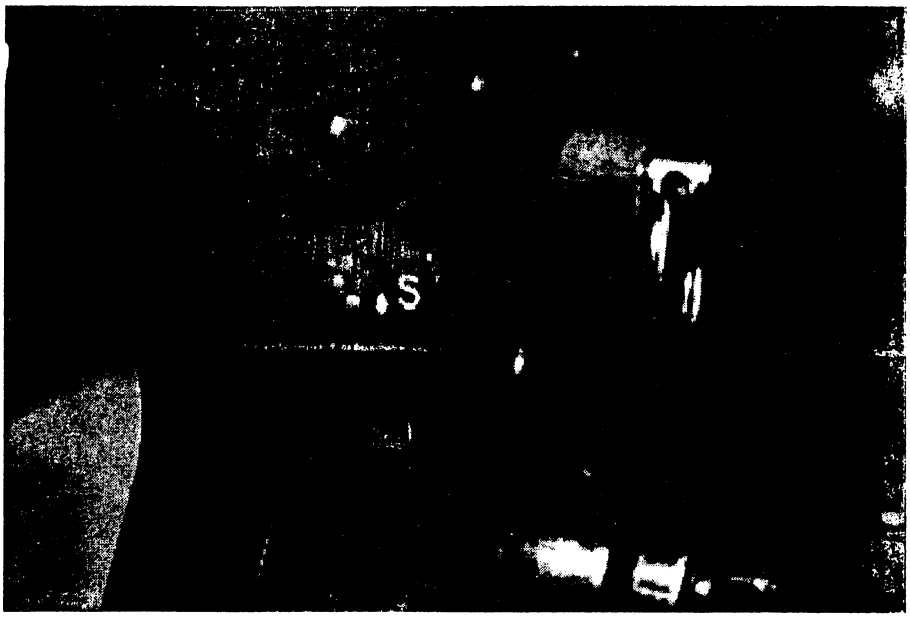


Fig 1-9. Weapon on "S."

(4) Push in latches to open cover assembly (see fig 1-10).

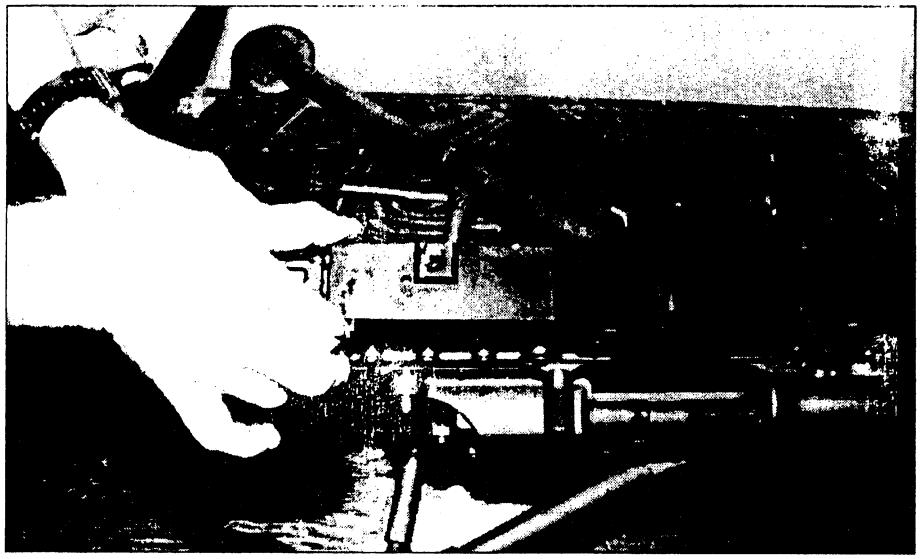


Fig 1-10. Opening cover assembly.

(5) Remove any ammo or links.

(6) Raise feed tray (see fig 1-10).

(7) Visually and physically inspect the chamber to make sure it is empty (see fig 1-11). If a round is still in the chamber, remove it.

(8) Lower feed tray.

(9) Place safety on "F."

(10) Pull the cocking handle to the rear and hold, depress trigger, and ride the bolt home, ensuring the cocking handle is all the way forward.

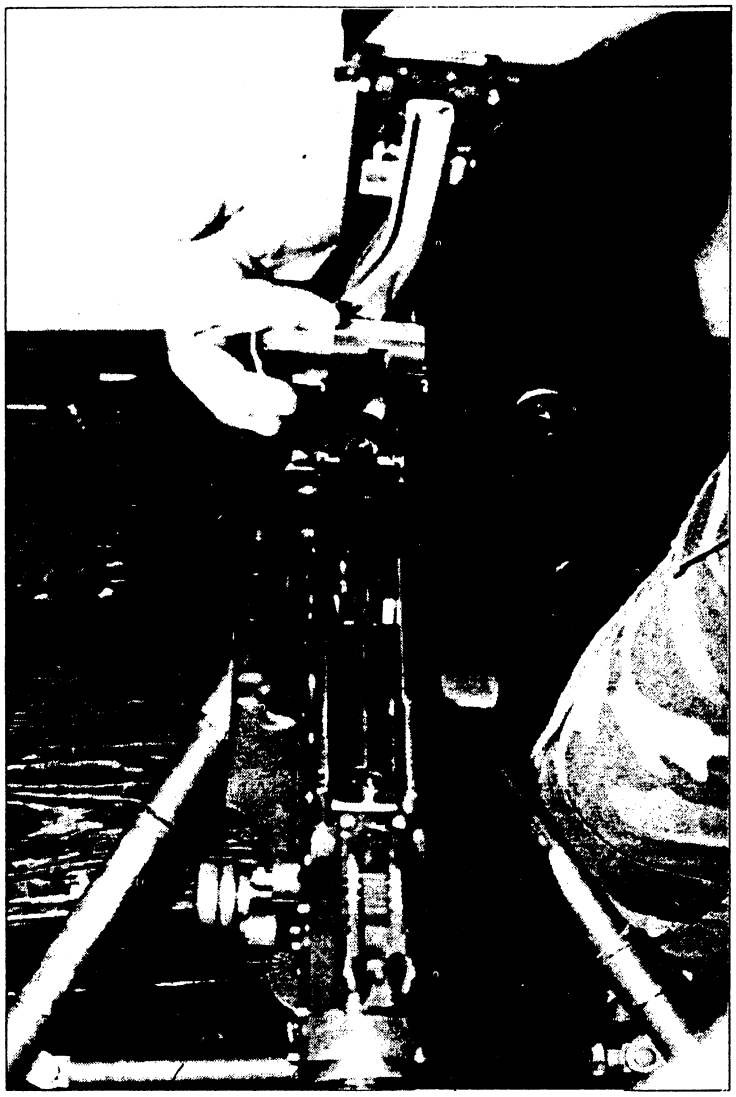


Fig 1-11. Checking chamber.

Time for a quiz!

What have you learned so far? Can you list below the steps for clearing the M240G?

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____

Let's see how much you have learned! If your answers are the same as those provided on the next page, then you are doing well! You may continue to the next page. However, if you didn't know the correct answers, go back and study the steps until you can list them in correct order. Remember, everybody learns at a different pace, so keep up your efforts!

ANSWERS

1. Place the safety on "F."
2. Pull cocking handle to the rear to lock bolt back and return the charging handle to the forward position.
3. Place safety on "S."
4. Push in latches to open cover assembly.
5. Remove ammo belt or links.
6. Raise feed tray.
7. Look into chamber to make sure it is empty. If a round is still in the chamber, remove it.
8. Lower feed tray.
9. Place safety on "F."
10. Pull cocking handle to rear and hold, depress trigger, and ride the bolt home, ensuring the cocking handle is all the way forward.

1203. Field-stripping the M240G Machinegun

Note: Before attempting to handle any weapon, make sure YOU personally clear the weapon.

a. To field-strip the M240G machinegun, follow the steps below:

(1) **FIRST**, remove the barrel (see fig 1-12).

(a) Depress and hold the barrel locking latch (1).

(b) At the same time, rotate the barrel carrying handle assembly to the (2) upright position.

(c) Remove barrel by pulling straight out (3).

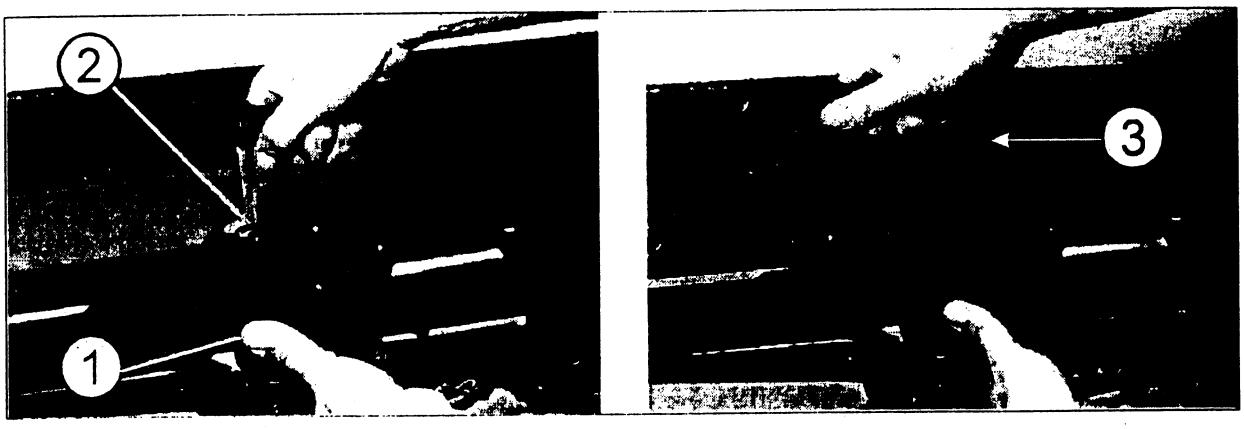


Fig 1-12. Removing the barrel.

Note: Laying the barrel on its right side will make reassembling the weapon easier for you.

(2) **SECOND**, remove the trigger housing group (see fig 1-13).

(a) Depress spring (1).

(b) Remove spring pin (2).

(c) Pull trigger housing group back and down (3).

Fig 1-13. Removing the trigger housing group.

(3) **THIRD**, remove the buttstock (see fig 1-14).

(a) Depress the buttstock release latch; be sure to press all the way in (1).

(b) Lift the buttstock while holding the receiver with your free hand (2).

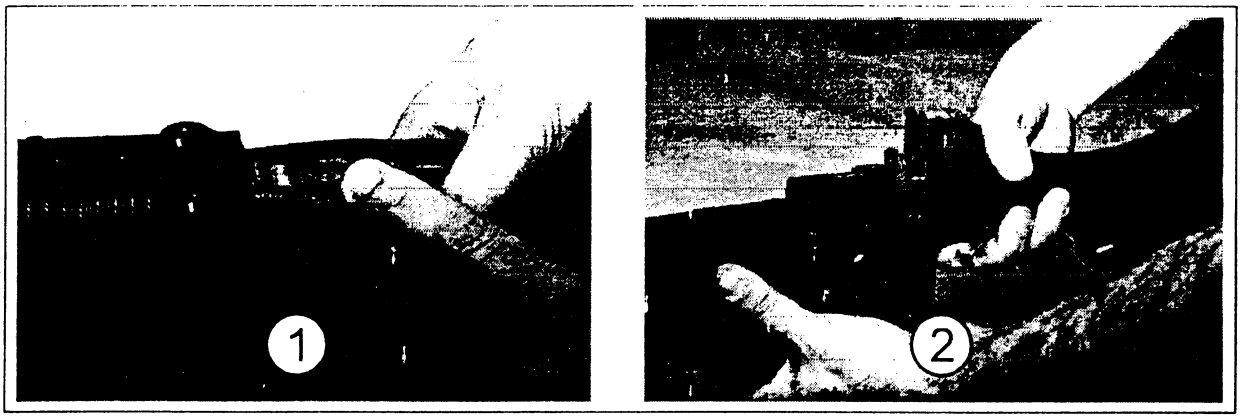


Fig 1-14. Removing the buttstock.

(4) **FOURTH**, remove the drive spring rod (see fig 1-15).

(a) Push the drive spring rod back and up (1).

(b) Lift the rod out of the receiver (2).

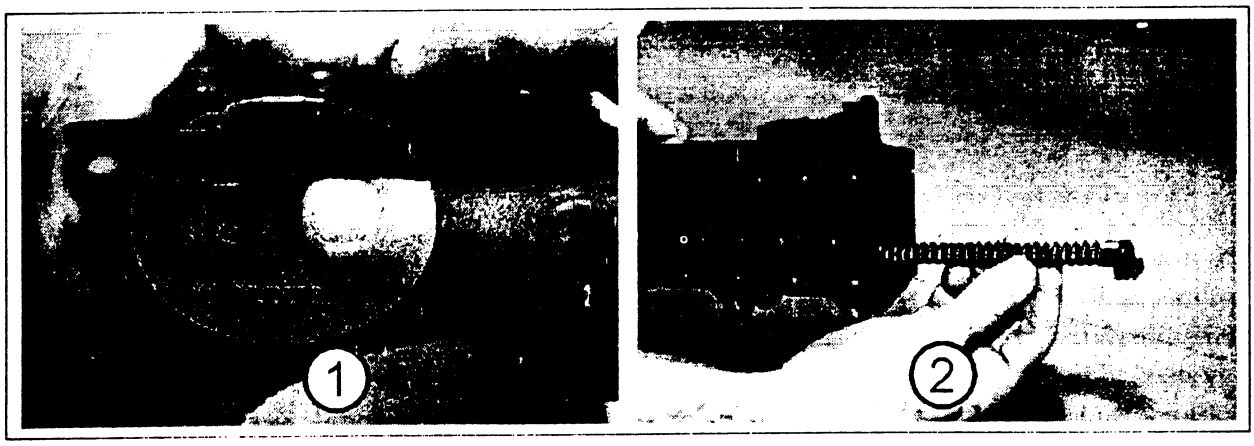


Fig 1-15. Removing drive spring rod.

(5) **FIFTH**, remove the operating group (see fig 1-16).

(1) Depress cover latches and raise cover assembly (1).

(2) Pull cocking handle to rear (2).

(3) Slide the bolt and operating rod assembly to the rear (2).

(4) Remove the bolt (3).

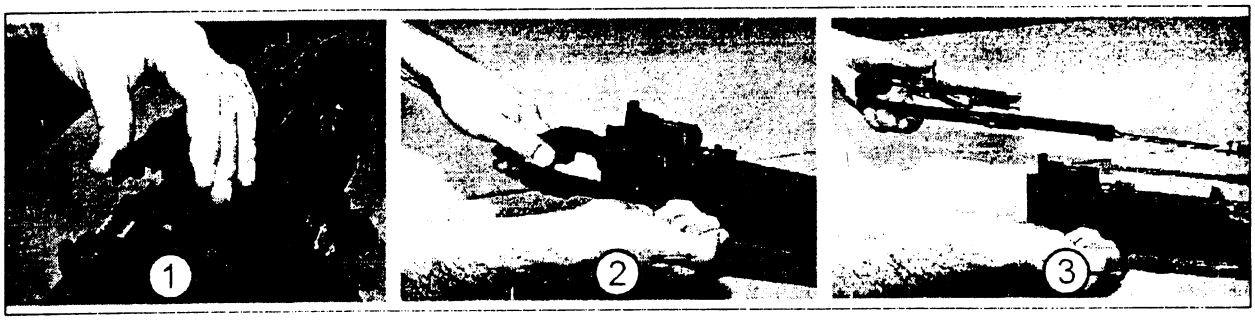


Fig 1-16. Removing the operating group.

Time to test your knowledge! List below the five steps required to field-strip the M240G.

1. _____

2. _____

3. _____

4. _____

5. _____

Check your answers with the ones below. If you knew the correct steps, good for you! You may continue with the lesson. If not, review the material until you can list the steps in correct order. Remember, the learning experience differs between individuals. As a hard-charging Marine, you may need to put in more or less time and effort than your buddy to learn the same material. Learning is an individual experience. What is important is that you learn! Keep charging!

ANSWERS

1. Remove the barrel.
2. Remove the trigger housing assembly.
3. Remove the buttstock and buffer assembly.
4. Remove the drive spring rod.
5. Remove the bolt and operating rod assembly.

1204. Detailed Disassembly and Assembly of the M240G Machinegun

Note: This section refers only to those disassembly and assembly procedures that are authorized at the **OPERATOR'S** level. Disassembly in detail beyond what is described in this section is **NOT AUTHORIZED**, except by qualified ordnance personnel.

a. Operating group

(1) Detailed disassembly (see fig 1-17)

(a) To separate the operating rod and bolt, remove the hinge spring pin (1) that holds them together.

(b) Then, pull the bolt (2) forward until it is clear of the firing pin; this disengages the bolt from the operating rod (3).

This completes detailed disassembly of the operating group. The firing pin remains affixed to the operating rod, and the ejector and extractor remain affixed to the bolt.

(2) Detailed assembly (see fig 1-17)

(a) To join the bolt and operating rod, hold the rod (3) in one hand.

(b) Position the rear of the bolt (2) and slide it over the firing pin.

(c) Align the holes on the bolt with those on the operating rod.

(d) Push the hinge spring pin (1) through the holes to secure the two assemblies together. You can insert the pin from the left or the right.

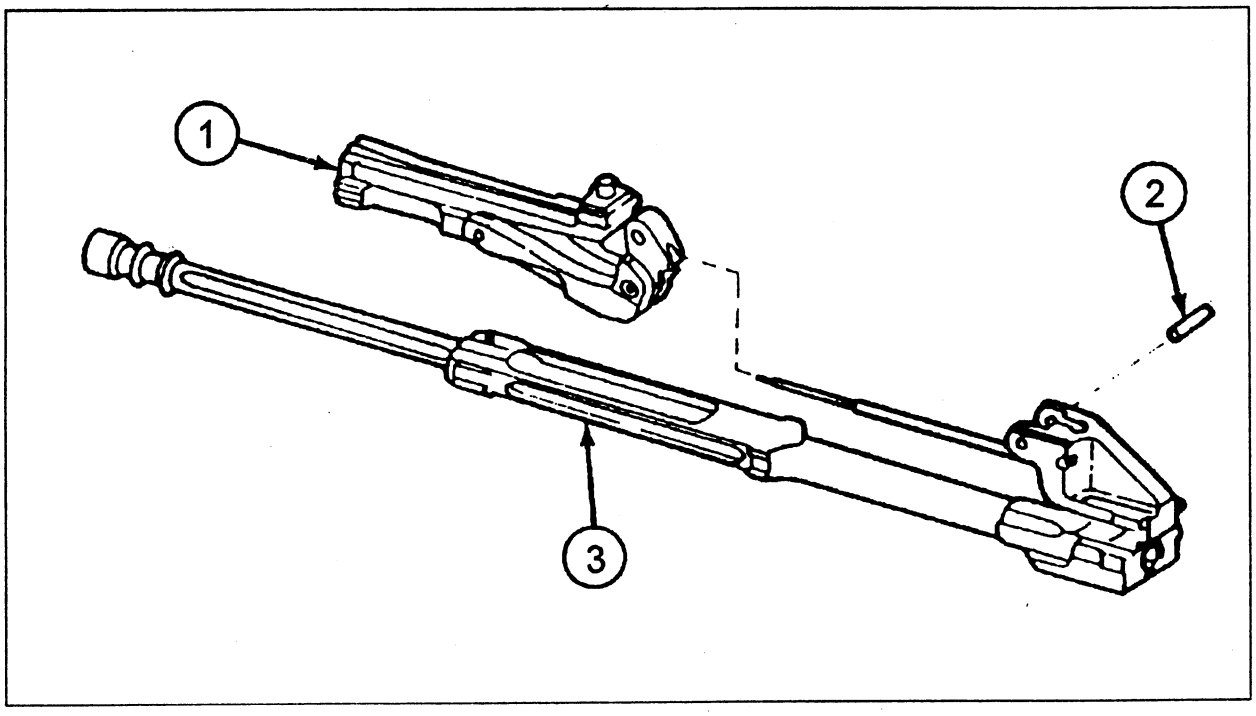


Fig 1-17. Detailed disassembly and assembly of the operating group.

b. **Barrel** group assembly

(1) Detailed disassembly (see fig 1-18)

(a) Hold the barrel at the point where the gas system attaches to it

(b) Grasp and rotate the collar clockwise until it releases from the gas plug (1).

(c) Remove the collar from the gas plug (2).

(d) Slide the gas plug to the rear and out of the gas regulator (2).

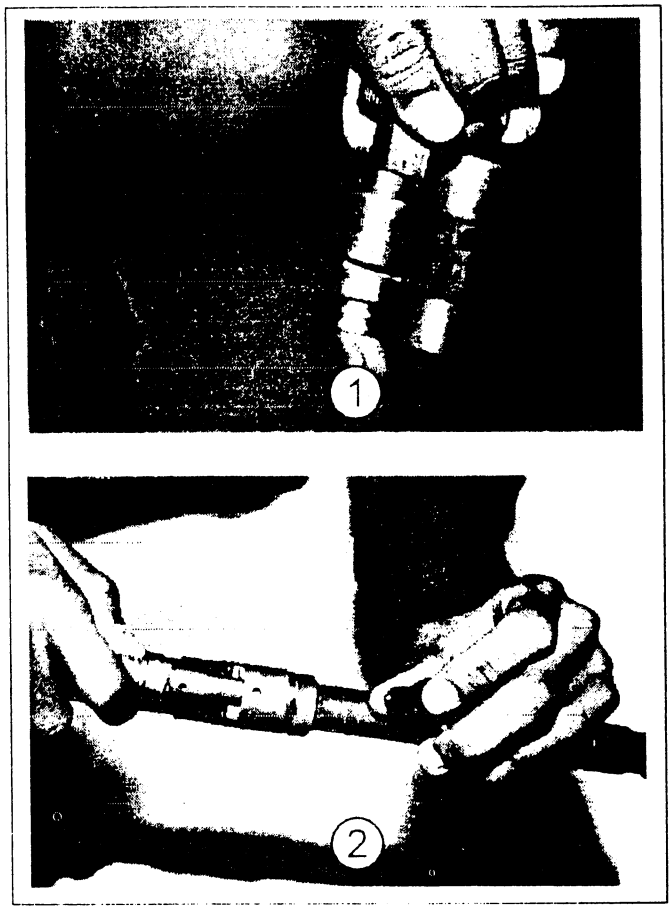


Fig 1-18. Removing the collar and gas plug.

(2) Detailed assembly

(a) Insert the gas plug into the gas regulator.

(b) Place the collar over the forward end of the plug.

(c) Push against the face of the collar while rotating counterclockwise until the collar locks into place.

(d) Pull on the collar to ensure it is in the locked position.

c. Receiver group

(1) Detail disassembly. To remove the cover and feed tray, follow the steps below (see fig 1-19):

(a) To remove the cover, first ensure the cover is closed.

(b) Then, pull the hinge spring pin out.

(c) Lift the cover (1) and feed tray (2) from the receiver.

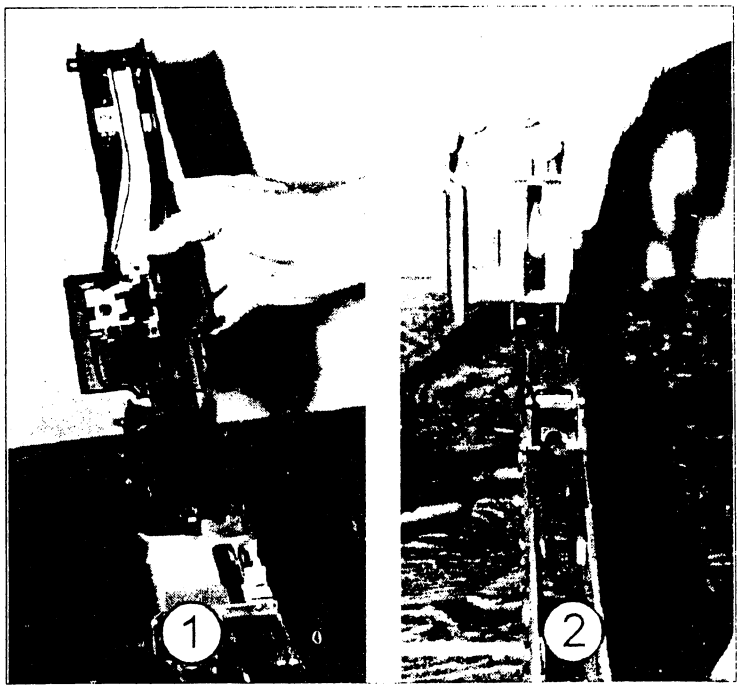


Fig. 1-19. Detailed disassembly of the receiver group.

(2) Detailed assembly. To replace the feed tray, follow these steps:

(a) Lay the feed tray on the receiver so the feed tray guides are aligned with the receiver brackets.

(b) Push down until the feed tray cover closes. The mounting holes will be aligned.

(c) Insert the cover hinge spring pin into the holes to affix the cover and tray to the receiver.

1205. Mounting the M240G Machinegun on the M122 Tripod

a. Mounting the flex mount assembly on the M122 tripod mount (see fig 1-20)

(1) Place the pintle assembly (1) of the flex mount assembly into the sleeve bushing (2) on the M122 tripod mount.

(2) Release the pintle lock assembly (3) to secure flex mount assembly to the M122 tripod.

(3) Place the T&E mechanism (4) onto the traverse bar assembly (5) of the M122 tripod mount.

(4) Lock the T&E mechanism (4) into place by turning the traversing lever (6) clockwise.

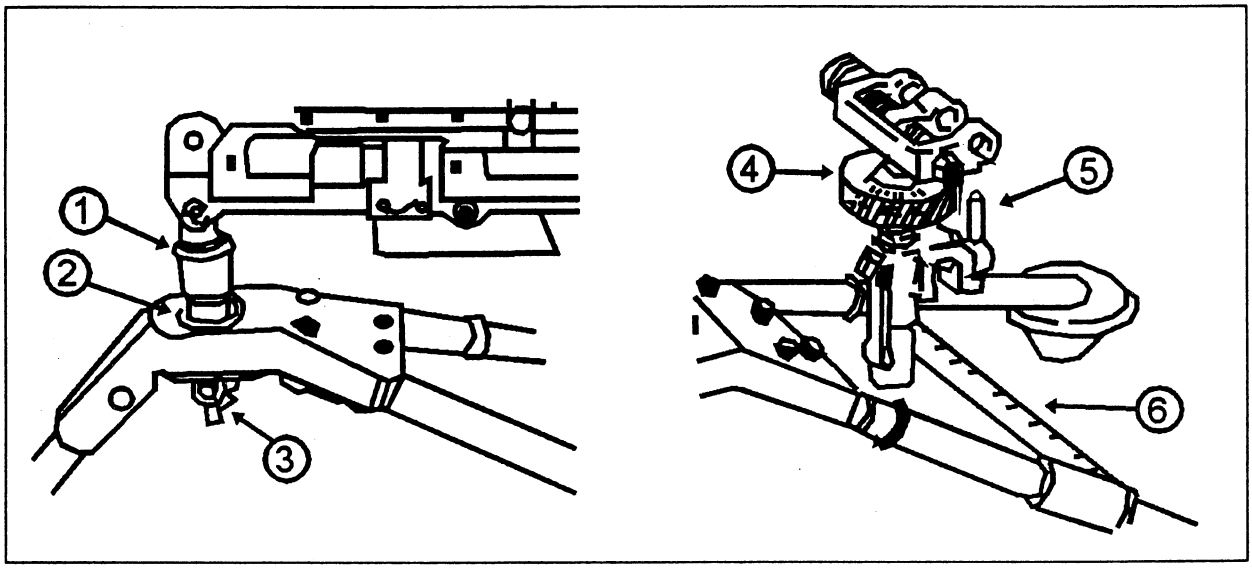


Fig 1-20. Mounting the flex mount.

b. **Mounting the M240G machinegun on the flex mount assembly (see fig 1-21)**

(1) **Position the weapon over the M122 tripod mount and flex mount assembly.**

(2) **Tilt the muzzle down and insert the receiver bushings (1) into the front cradle slot (2) of the flex mount assembly.**

(3) **Pull the weapon to the rear to fully seat the receiver bushing in the cradle.**

(4) **Lower the rear of the weapon onto the flex mount. Align the mounting hole (3) in the trigger housing with the mounting hole (4) in the flex mount assembly.**

(5) **Insert the spring pin (5) through the hole in the flex mount and receiver. Ensure the weapon is securely attached to the flex mount.**

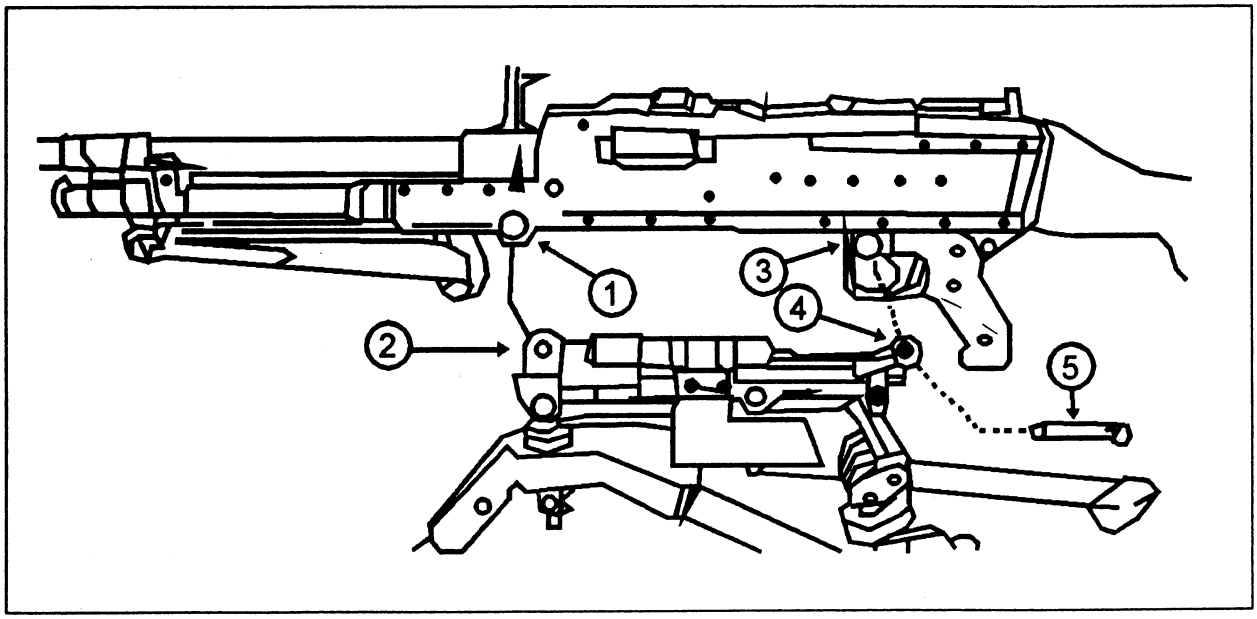


Fig 1-21. Connecting the M240G to the flex mount assembly.

1206. Maintenance

a. Cleaning materials. Only three cleaning materials are authorized for cleaning the M240G--CLP, RBC, and dry cleaning solvent. Table 1-2 below indicates proper use of these materials.

Table 1-2. M240G Cleaning Materials

Cleaner	When to Use
Cleaner-lubricant-preservative (CLP)	Daily
Rifle-bore cleaner (RBC)	Daily
Dry cleaning solvent	Daily, but **not** on rubber or plastic parts

Note: If you use dry cleaning solvent, make sure all cleaned parts are thoroughly lubricated with CLP.

b. Cleaning. Steps 1 through 11 that follow cover the detailed cleaning of the barrel group using the tools located in the spare barrel carrying case. Clean the rest of the weapon with authorized cleaning products using rags and an all-purpose brush.

Warning: It is PROHIBITED to use gasoline, kerosene, hydraulic fluid or oil, benzene, high pressure water, steam, or high pressure air for cleaning.

Notes: Do not use abrasives to clean the bore, piston, gas cylinder, or gas regulator plug.

Do not apply lubricants or dry cleaning solvent to plastic or rubber parts.

(1) Remove the cover from the scraper. Insert scraper into the center hole of the plug. Twist the scraper back and forth to remove carbon (see fig 1-22).

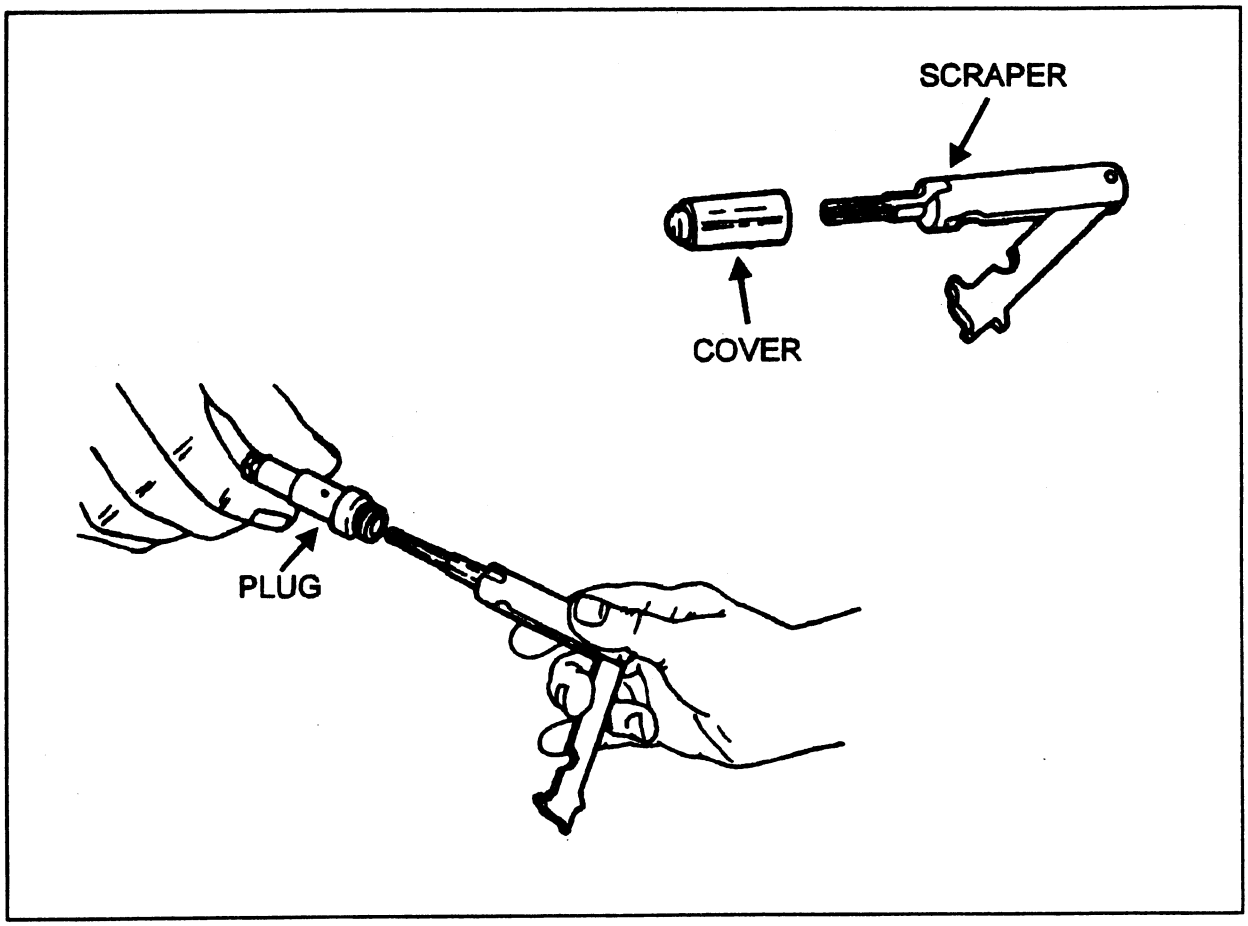


Fig 1-22. Cleaning the gas plug.

(2) **Fold the scraper.** Press the point into the groove. Twist the plug back and forth to remove carbon from the groove on the plug (see fig 1-23).

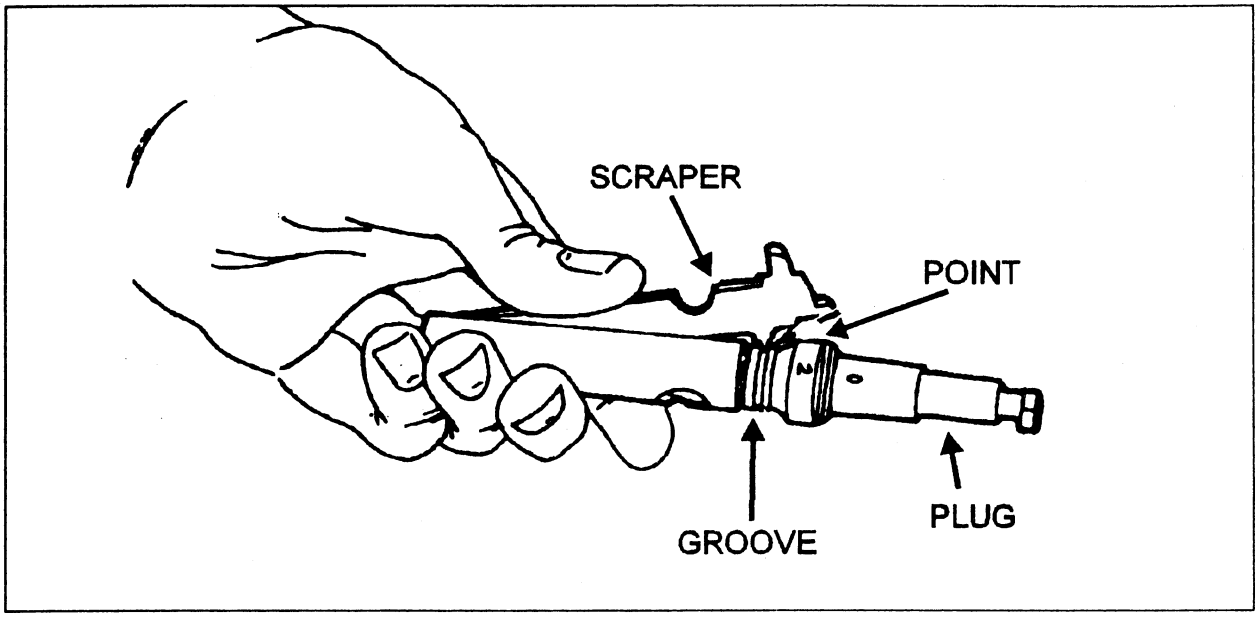


Fig 1-23. Cleaning the groove on the gas plug.

(3) Pivot the scraper blade. Clean carbon from the second groove (see fig 1-24).

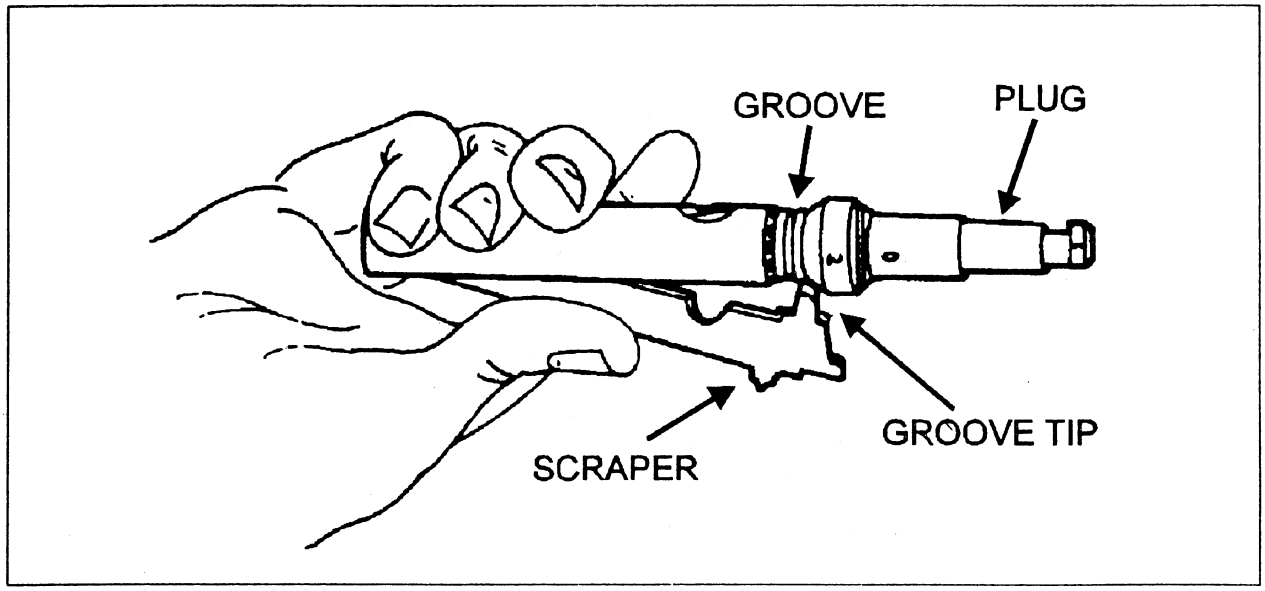


Fig 1-24. Cleaning the second groove.

(4) **Scrape carbon from surfaces of the plug with the tip of the scraper** (see fig 1-25).

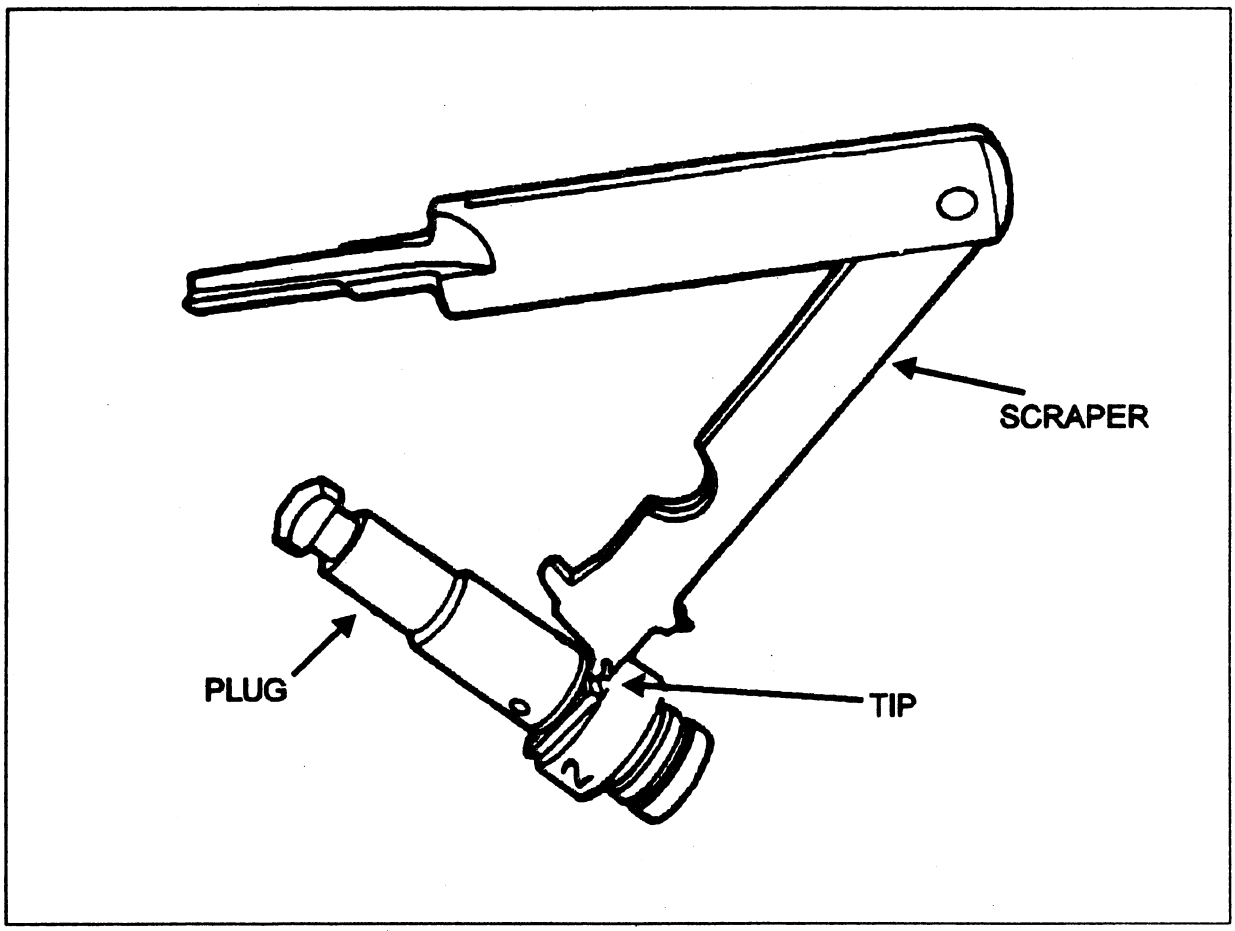


Fig 1-25. Cleaning the plug surfaces.

(5) To clear the holes of carbon, insert the small reamer into the gas inlet holes on the plug. Now insert the large reamer into the gas port hole in the barrel (see fig 1-26).

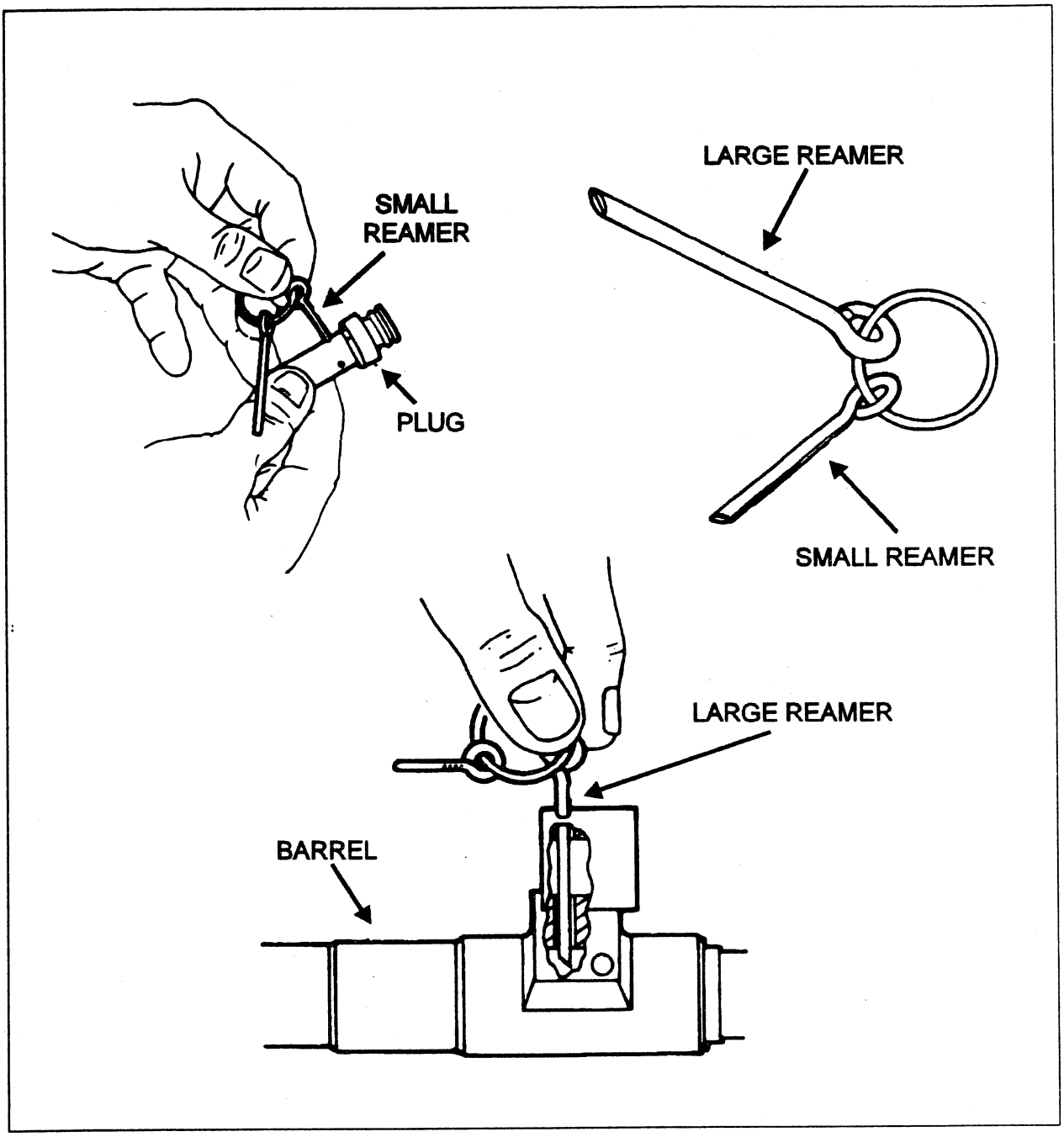


Fig 1-26. Cleaning gas ports.

(6) Insert the combination tool into the cavity of the piston end of the operating rod. Squeeze the handles firmly. Twist the combination tool back and forth to remove carbon (see fig 1-27).

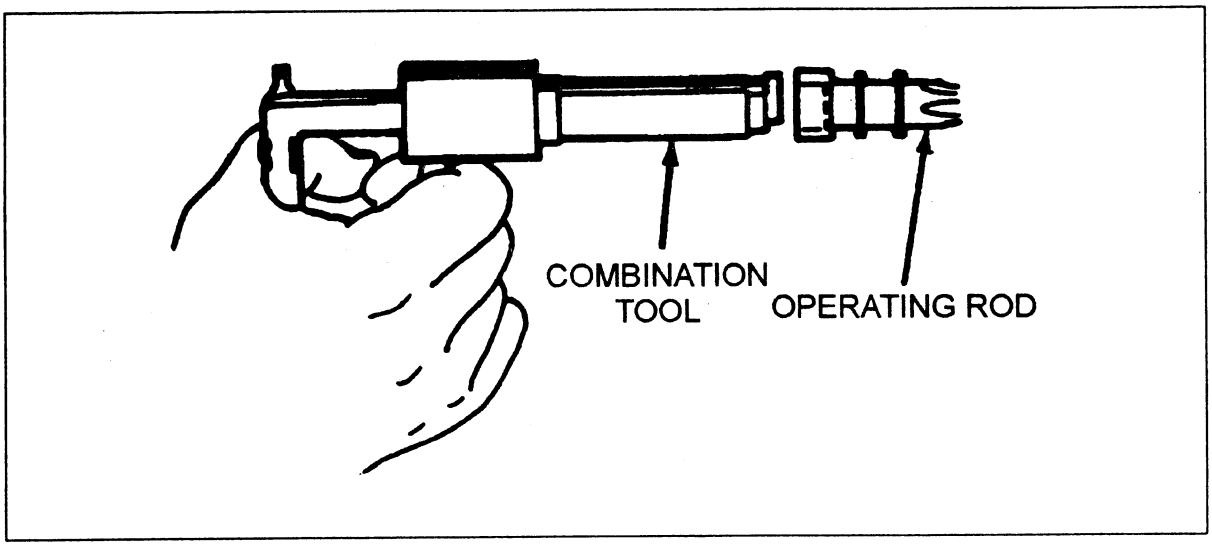


Fig 1-27. Cleaning piston cavity.

(7) Insert the screwdriver end of the combination tool into the cavity of the piston end of the operating rod to remove carbon residue in the bottom of the cavity (see fig 1-28).

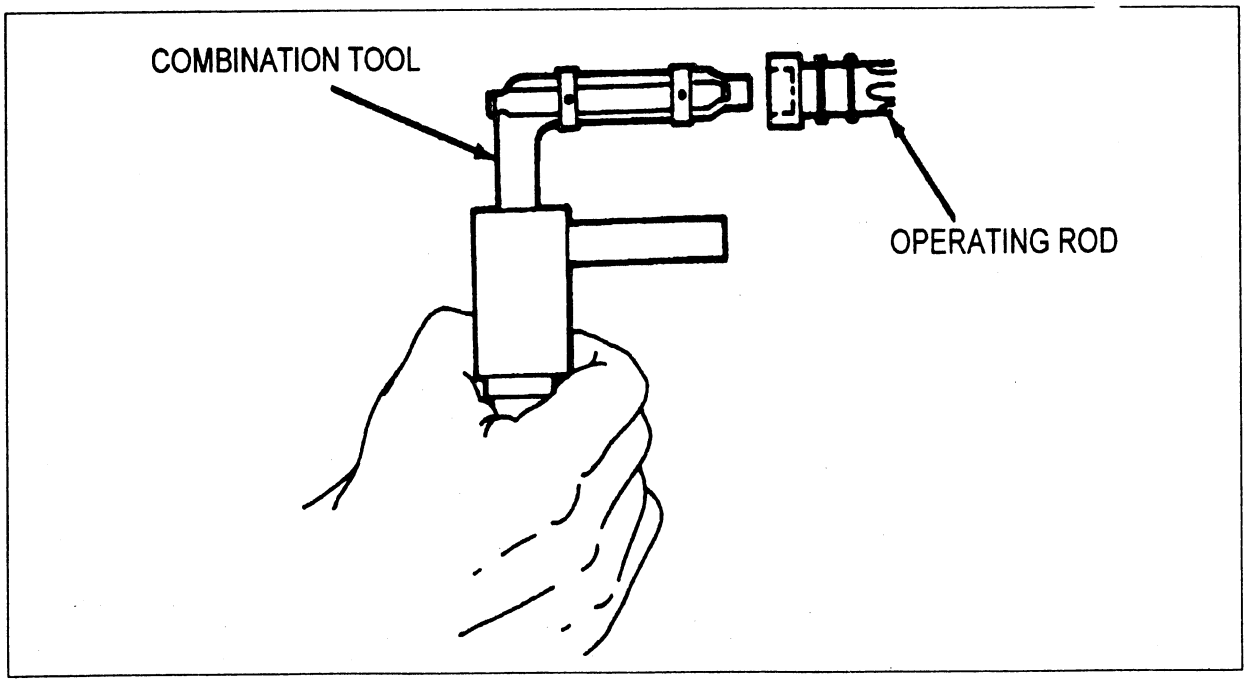


Fig 1-28. Cleaning the bottom of piston cavity.

(8) Insert the combination tool carefully into the fore end of the gas cylinder of the receiver body (see fig 1-29).

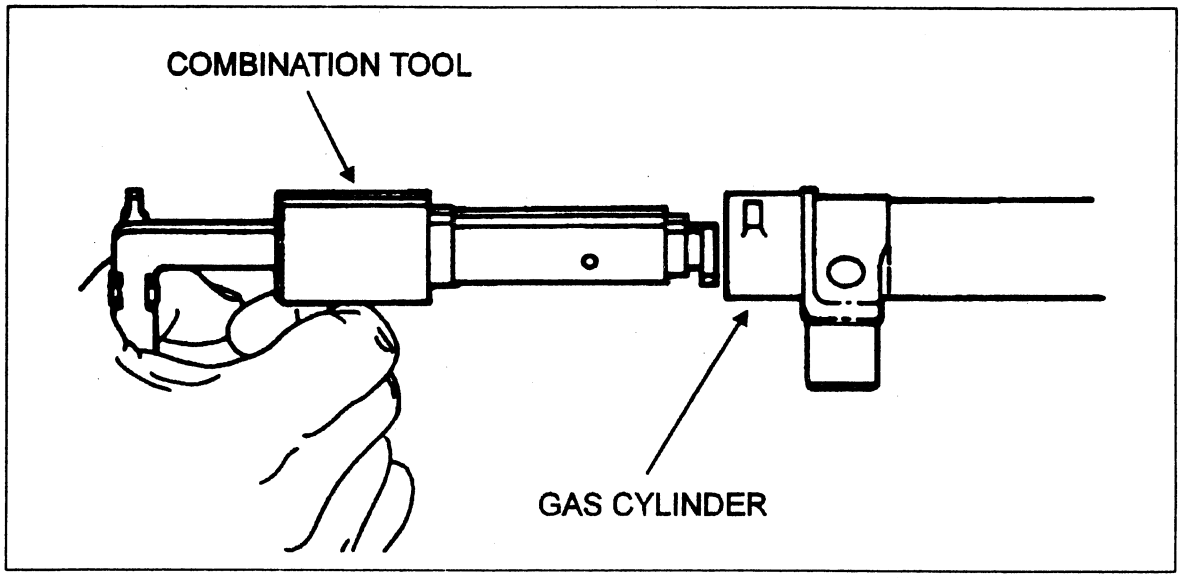


Fig 1-29. Inserting the combination tool into the fore end.

(9) Ensure the combination tool shoulder is fully inserted and seated against the fore end of the gas cylinder in the receiver body. Apply slight pressure to the handles. Twist back and forth to remove carbon (see fig 1-30).

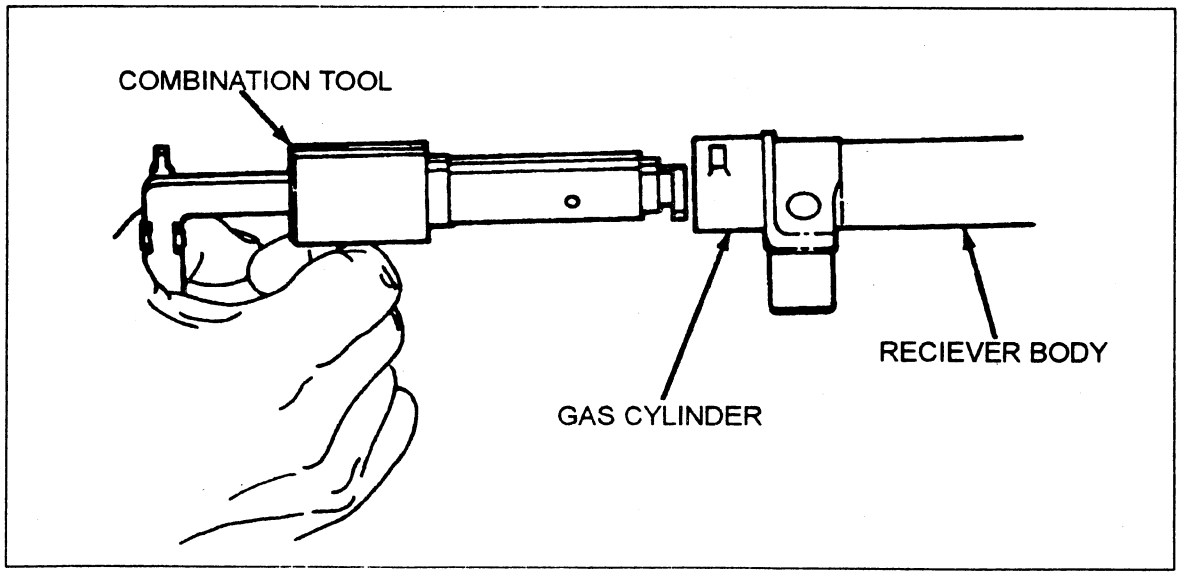


Fig 1-30. Removing carbon from gas cylinder.

(10) Clean the gas cylinder bore with a gas cylinder cleaning brush dampened with CLP or RBC (see fig 1-31).

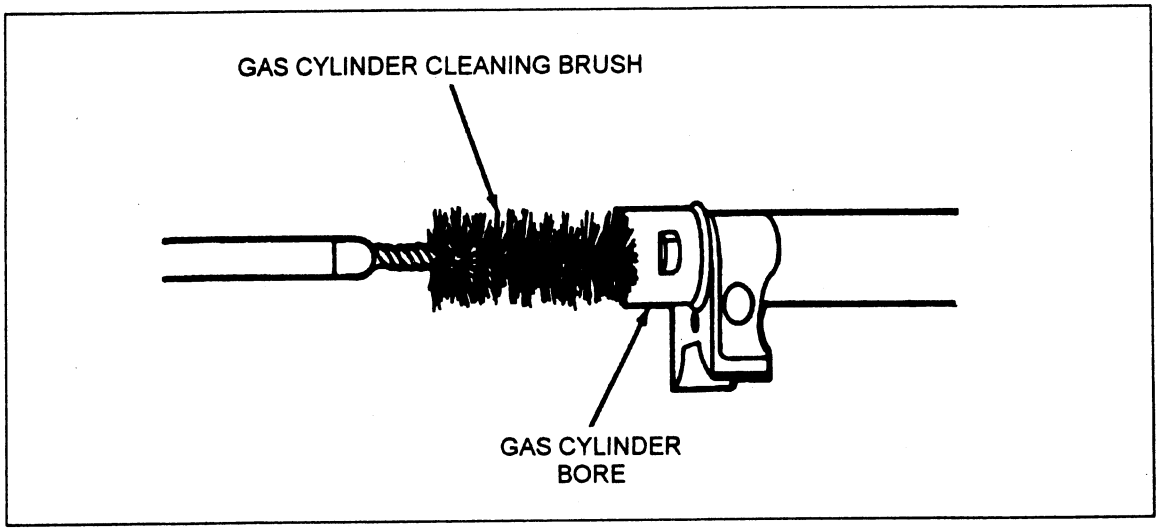


Fig 1-31. Using a gas cylinder brush.

(11) Remove dirt and corrosion from the gas cylinder bore using a cleaning rod and swab dampened with CLP.

?	What three cleaners are authorized for cleaning the M240G? Did you answer "CLP, RBC, and dry cleaning solvent"? Great job!

c. Inspect the weapon.

(1) Check for burrs, cracks, and wear, especially on the barrel threads and notches.

(2) Make sure the flash hider (suppressor) is tight.

(3) Inspect the buttstock and buffer assembly for rust, cracks, and other damage.

(4) Inspect the receiver and feed cover.

(5) Check the feed cover parts for cracks and burrs.

(6) Check the feed cover for movement and parts that are bent or missing.

(7) Check the feed tray for cracks and burrs.

(8) Inspect the receiver rails.

(9) Check the bolt group.

(10) Inspect the extractor assembly for cracks and weak springs.

(11) Inspect the face of the bolt for cracks and burrs.

d. Lubricant. The four authorized lubricants for the M240G are CLP, LSA, LSA-T, and LAW. The following table indicates the proper use of each lubricant.

Table1-3. Lubricant Use

When To Use	CLP	LSA	LSA-T	LAW
In all but the coldest climates	✓	✓	✓	
Temperatures between 10 degrees F and -10 degrees F	✓	✓		✓
Temperatures below -10 degrees F				✓
In a hot and humid climate	✓	✓	✓	
In a hot and dry climate	✓		✓	

After cleaning, the next step is proper lubrication. You must be sure all metal parts are coated sufficiently with CLP to prevent damage from the elements. Table 1-4 below shows the major components of the M240G and guidelines for lubricating each group with CLP.

Table 1-4. Guidelines for Lubricating the Major Components of the M240G

GROUP	GUIDELINES
Barrel group	Apply a light coat on all metal parts. Coat inside of the barrel by putting a small amount of CLP on a patch and running it through barrel with a rod.
Buttstock and buffer group	Apply a light coat on all metal parts.
Drive spring rod assembly group	Apply a very light coat on the spring and apply a light coat on the rod.
Bolt and operating rod group	Apply a moderate coat on the bolt and operating rod. After reassembly, move bolt back and forth to work CLP into the receiver rails.
Trigger housing group	Apply a light coat on the metal parts only.
Cover group	Apply a light coat. Move feed cam back and forth to work CLP into tight places.
Feed tray	Apply a light coat.
Receiver group	Apply a light coat on all metal parts.

?	Who is responsible for cleaning and maintaining the M240G? **YOU ARE !**

Lesson Summary. In this lesson you learned how to clear, field-strip, assemble, mount, and maintain the M240G. Exercise questions on the information covered in study unit one follow.

Study Unit 1 Exercise: Complete items 1 through 21 by performing the action required. Check your responses against those listed at the end of this study unit.

Identification: For items 1 through 3, circle the letter of the most correct answer.

1. Identify the list of characteristics that describe the M240G machinegun.

   a. Bolt-fed
Gas-operated
Water-cooled
Automatic

   b. Belt-fed
Recoil-operated
Air-cooled
Automatic

   c. Belt-fed
Gas-operated
Air-cooled
Automatic

   d. Magazine-fed
Gas-operated
Air-cooled
Automatic

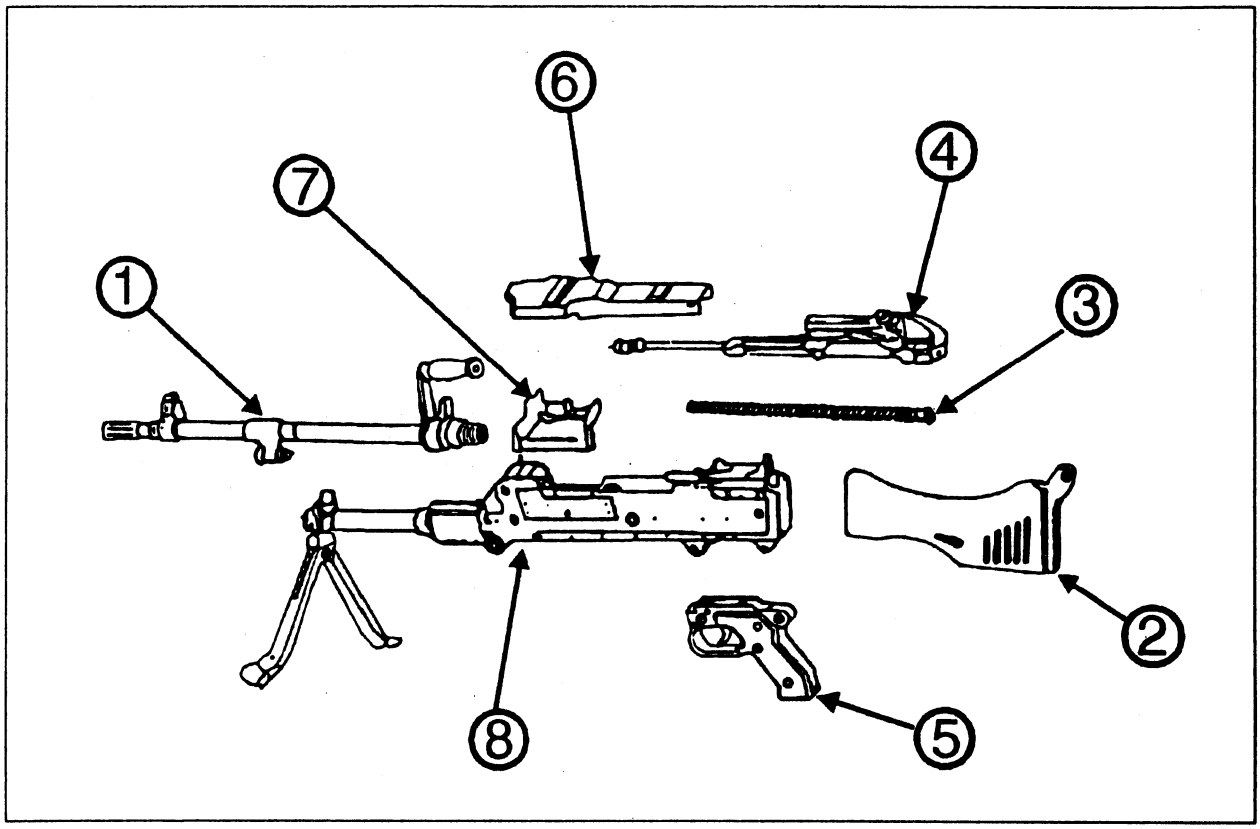
2. What is the approximate weight (in pounds) of the M240G machinegun?

   a. 32
   b. 15
   c. 24.2
   d. 6.6

3. What is the maximum effect range (in meters) of the M240G using the T&E mounted on the M122 tripod?

   a. 1775
   b. 1800
   c. 1500
   d. 1825

Matching: For items 4 through 8, use the illustration below. Match the numbered part of the illustration listed in column 1 with the correct M240G major components listed in column 2. Place your responses in the spaces provided.



Column 1		Column 2	
Part in illustration		Major components of 240G	
___	4. (3)	a.	Barrel group
___	5. (6)	b.	Bolt and operating rod group
___	6. (4)	c.	Cover group
___	7. (1)	d.	Drive spring rod assembly group
___	8. (5)	e.	Trigger housing assembly group

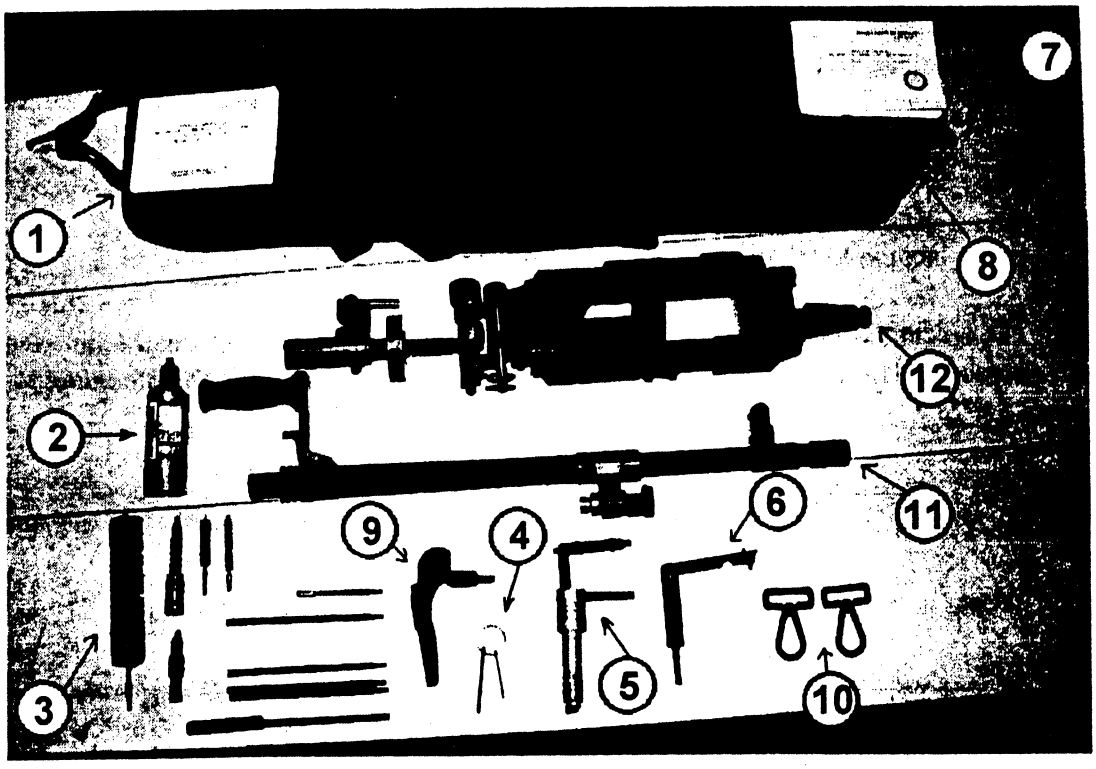
9. The front sight on the M240G machinegun is fully adjustable for

a. elevation only.
b. windage and elevation.
c. windage only.
d. meters and yards.

10. The M240G machinegun's rear sight in the down position can be adjusted for ranges between _____ meters.

a. 150 to 600
b. 200 to 500
c. 200 to 800
d. 300 to 750

Matching: For items 11 through 14, refer to the illustration below. Match the numbered item in column 1 with its correct description in column 2. Place your responses in the spaces provided.



Column 1 Item in illustration	Column 2 Description of item
___ 11. (4)	a. Combination scraper and extractor
___ 12. (9)	b. Combination regulator scraper
___ 13. (6)	c. Cleaning reamer
___ 14. (5)	d. Ruptured cartridge extractor
	e. CLP bottle
	f. Cleaning rods

15. What type of ammunition is used during the night or at times of limited visibility?

a. M82 blank
b. M61 armor-piercing
c. M62 tracer
d. M63 dummy

16. After pointing the weapon in a safe direction, what is the next step in clearing the M240G?

a. Place safety to "F."
b. Place the safety on "S."
c. Pull the cocking handle to the rear.
d. Lift the feed cover.

17. After clearing the weapon, what is the next step to field-strip the M240G?

a. Remove the barrel.
b. Remove the drive spring.
c. Remove the trigger housing assembly.
d. Remove the cover assembly.

18. For a detail disassembly of the receiver, the operator must first ensure the cover is closed. Then, the operator pulls the hinge spring pin out and lifts the cover and _____ from the receiver.

a. butt plate
b. cam
c. feed tray
d. trigger

19. What is the first step in mounting the flex mount on the M122 tripod?

a. Lock the T&E mechanism into place by turning the traversing lever clockwise.
b. Place the T&E mechanism onto the traverse bar assembly of the M122 tripod mount.
c. Release the pintle lock assembly to secure flex mount assembly to the M122 tripod.
d. Place the pintle assembly of the flex mount assembly into the sleeve bushing on the M122 tripod mount.

20. What is the first step in mounting the M240G to the flex mount?

a. Insert the spring pin through the hole in the flex mount and receiver. Make sure the weapon is securely attached to the flex mount.
b. Tilt the muzzle down and insert the receiver bushings into the front cradle slot of the flex mount assembly. Pull the weapon to the rear to fully seat the receiver bushing in the cradle.
c. Lower the rear of the weapon onto the flex mount. Align the mounting hole in the trigger housing with the mounting hole in the flex mount assembly.
d. Position the weapon over the M122 tripod mount and flex mount assembly.

21. Which product may be used to lubricate the M240G?

a. WD40
b. CLP
c. SOS
d. CPL

UNIT SUMMARY

This study unit discussed the characteristics and nomenclature of the M240G machinegun. It also provided instruction on the disassembly and assembly of the M240G machinegun and discussed the equipment in the spare barrel carrying case. The next study unit introduces the operation of the M240G machinegun.

Study Unit 1 Exercise Solutions

		Reference
1.	c.	1101
2.	c.	1102
3.	b.	1102
4.	d.	1103
5.	c.	1103
6.	b.	1103
7.	a.	1103
8.	e.	1103
9.	b.	1104
10.	c.	1104
11.	c.	1105
12.	d.	1105
13.	b.	1105
14.	a.	1105
15.	c.	1106
16.	a.	1202
17.	a.	1203
18.	c.	1204
19.	d.	1205
20.	d.	1205
21.	b.	1206

STUDY UNIT 2

OPERATION OF THE M240G MACHINEGUN

Introduction. No matter whether your unit is conducting an offensive or defensive mission, your ability as a machinegunner will make the difference between **success** and **failure**. The crucial point in any assault is when the attacking force either overruns the defending forces or the defending forces repel the attacker's assault. How you handle your M240G will have a lot to do with when that point occurs and which side prevails!

During an attack, the machinegun provides continuous, accurate, and controlled fire to allow the assault element to gain momentum. The M240G lets you and your unit attack and defeat the enemy while keeping friendly casualties to a minimum. Your ability to put accurate and continuous fire on the enemy's position determines whether the enemy is able to return a high volume of accurate fire.

Likewise, every defense operation also depends on its automatic weapons. Once again, your ability to deliver controlled, continuous, and accurate machinegun fire to repel the enemy's assaults determines the success or failure of your unit's defense. The M240G has a maximum effective range of 1800 meters. Within that range, the enemy has difficulty massing its forces to penetrate your defense.

As you can see, the M240G machinegun plays a key role in all areas of combat operations. The successful machinegunner rapidly loads and accurately fires, putting continuous and accurate fire on the enemy. The lives of fellow Marines depend on your ability to operate your machinegun and to keep it functioning. When the barrel needs to be changed or when the gun malfunctions, the successful machinegunner knows and follows proper procedures, performing immediate action and any other necessary corrective action, as needed.

Lesson 1. LOADING AND UNLOADING

LEARNING OBJECTIVES

1. Identify the condition codes that apply to the M240G machinegun.

2. Identify the sequence of steps for loading the M240G machinegun with the feed tray cover raised.

3. Identify the sequence of steps for loading the M240G machinegun with the feed tray cover closed.

4. Identify the sequence of steps for unloading the M240G machinegun.

2101. Condition Codes

a. Safety. Safety is paramount when handling weapons. To prevent injury, all weapons must be handled in a safe manner at all times. **Ignorance is not an excuse.** To ensure safety when firing the M240G machinegun, you must be familiar with its condition codes and the rules of weapons safety.

Note: Remember "TANK." This acronym is a memory aid for the four safety rules for all weapons:

Treat every weapon as if it were loaded.

Always keep your finger straight and off the trigger until ready to fire.

Never point a weapon at anything you don't intend to shoot.

Keep your weapon on safe until you intend to fire.

b. The condition codes. Table 2-1 below lists and describes all four condition codes for the M240G. All machinegunners should know these conditions.

Table 2-1. Condition Codes

CONDITION CODE	DESCRIPTION
Condition 1	Ammunition in position on feed tray Chamber empty Bolt locked to the rear Safety on safe ("S")
Condition 2	Not applicable to the M240G
Condition 3	Ammunition in position on feed tray Chamber empty Bolt forward Safety on safe ("S")
Condition 4	Feed tray clear of ammunition Chamber empty Bolt forward Safety on safe ("S")

2102. Loading

a. Position of feed tray cover. The M240G machinegun is capable of being loaded with the feed tray cover raised or closed.

(1) Raised feed tray cover loading

(a) Before loading. Before loading the M240G using the raised feed tray cover method, you must follow these steps:

1. Point the gun in a safe direction.

2. Lock bolt to the rear.

3. Place the safety on safe ("S").

4. Lock the cocking handle in the forward position.

5. Raise the feed tray cover.

6. Ensure chamber is clear.

(b) Loading. The steps for loading the M240G using the raised feed tray cover method are listed below:

1. The team leader opens the ammunition box by tearing off the tab marked by the silhouette of a round.

2. The team leader locates the end of the ammunition belt on the box and pulls out the first few rounds. He ensures the rounds come out of the box with the tips pointed toward the muzzle and with the solid part of the links facing up ("brass to the grass").

3. The team leader places the link belt in the feed tray with the first round against the cartridge stop (see fig 2-1).

4. While the team leader holds the belt in place, the gunner closes the feed tray cover and latches it frimly, without forcing it closed. **The machinegun is now in Condition 1 and fully loaded** (see fig 2-2).

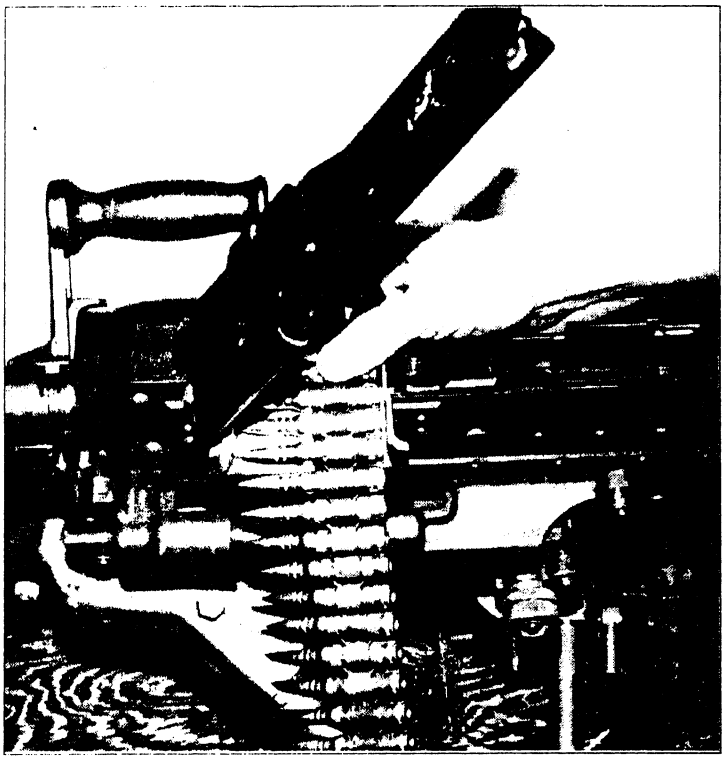


Fig 2-1. Loading the M240G.

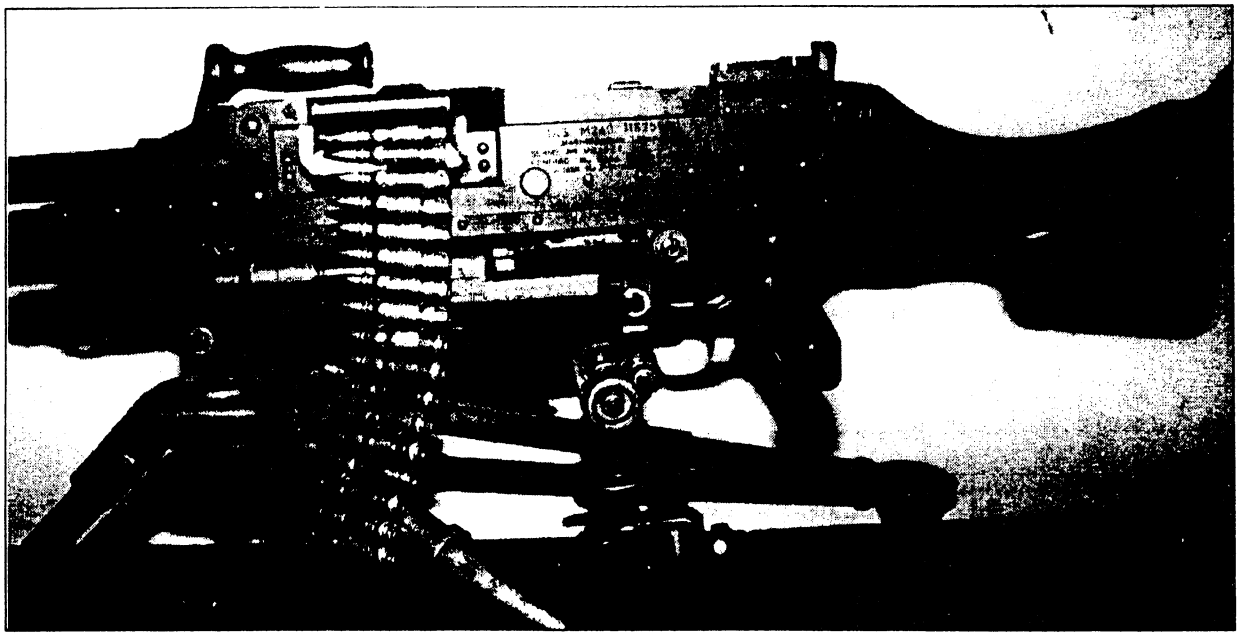


Fig 2-2. Fully loaded M240G machinegun.

(2) Closed feed tray cover loading

(a) Before loading. Before loading the M240G using the closed feed tray cover method, you must follow these steps:

1. Point the gun in a safe direction.

2. Ensure the bolt is resting forward on an empty chamber.

3. Place the safety in the fire position ("F").

(b) Loading. The steps for loading the M240G using the closed feed tray cover method are listed below:

1. The team leader opens the ammunition box by tearing off the tab marked by the silhouette of a round.

2. The team leader locates the end of the ammunition belt on the box and pulls out the first few rounds. He ensures the rounds come out of the box with the tips pointed toward the muzzle and with the solid part of the links facing up ("brass to the grass").

3. The team leader feeds the first round into the feedway until the holding pawl engages it and holds it in place.

4. The gunner pulls the cocking handle to the rear and ensures the bolt has been engaged by the sear; then he returns the cocking handle to the forward position and places the weapon on safe. **The machinegun is now in Condition 1 and fully loaded.**

Note: The differences between the two loading methods are in steps 4 and 5 and in the position of the safety.

2103. Unloading

To unload the M240G machinegun, follow the steps listed below:

a. Cease fire and keep the gun pointed down range and in a safe direction.

Note: If you had a misfire, then you should suspect a round remains in the chamber. See table 2-3 before continuing to unload the M240G. **Do not** raise the feed tray cover.

b. Pull the cocking handle to the rear and ensure the bolt has been engaged by the sear; then return the cocking handle to the forward position.

c. Place the weapon on safe.

d. Squeeze the cover latch and raise the feed tray cover.

e. Remove the ammunition belt and any remaining links from the feed tray.

f. Lift the feed tray and visually inspect the chamber to ensure the chamber is empty. If a round is in the chamber, run a cleaning rod down the barrel to knock the round out.

Lesson Summary. This lesson covered the condition codes of the M240 and the loading and unloading procedures. The next lesson covers zeroing the M240G.

Lesson 2. ZEROING THE M240G MACHINEGUN

LEARNING OBJECTIVES

1. Identify the illustration with the correct sight alignment for the M240G machinegun.

2. Identify the illustration with the correct sight picture for the M240G machinegun.

3. Identify the correct description of the firing position of the gunner and the team leader when firing the M240G machinegun.

4. Select the correct sequence of steps for zeroing the M240G machinegun on a 12.7 meter range.

5. Select the correct sequence of steps for field zeroing the M240G machinegun on a distant aiming point.

6. Select the correct procedure for zeroing the spare barrel of the M240G machinegun.

2201. Sight Alignment

a. General purpose and standards. Simply shooting rounds down range is not enough! Putting accurate fire on the enemy is what defeats the enemy and saves fellow Marines. However, before any weapon can accurately engage the enemy, certain standards must be met.

(1) The first standard to meet is to make sure your weapon is zeroed.

(2) The second standard requires that sight alignment and the sight picture must be present when firing your weapon.

b. Alignment of front and rear sights. Alignment of both front and rear sights is very important. Machinegunners often forget this basic principle of marksmanship because they only use the rear sight when firing the first burst. However, the fire of the first burst is very important.

(1) For several reasons, the accuracy of your first burst determines how effective your fire will be.

(a) First, the enemy will likely seek cover as soon as they realize you are firing on them.

(b) Second, the psychological effect of your fire is directly related to how real the enemy perceives the threat.

(c) Third, you don't want to lose the element of surprise. If your initial burst is either on target or close to it, the enemy has less time to react effectively and gain cover before you adjust.

(2) Sight alignment is composed of three elements.

(a) Point of focus of your eye

(b) Relative position of the front sight post horizontally

(c) Relative position of the front sight post vertically

c. Sight alignment on the M240G. The M240G is unique because the rear sight can be adjusted for two different settings. One adjustment of the rear sight is for 800 meters or less, and another adjustment of the rear sight is for 800 to 1800 meters. As you read this material, closely observe figures 2-3 and 2-4.

(1) 800 meters or less. Figure 2-3 shows the proper sight picture you should have when using the sight in the 800-meter-or-less position. In this position, notice a bar centered in the sight.

For 800 meters or less, the point of focus for your eye should be at the very center tip of the front sight post. Focusing here will cause the image of the rear sight aperture and target to become blurry. This condition cannot be avoided because your eye can focus only on one single point at a time.

(2) 800 to 1800 meters. Figure 2-4 shows the proper sight picture you should have when using the sight in the 800-to-1800-meter position. In this position, notice the cross hairs centered in the sight.

For 800 to 1800 meters, you will center the front sight post vertically and horizontally in the image of the rear sight aperture.

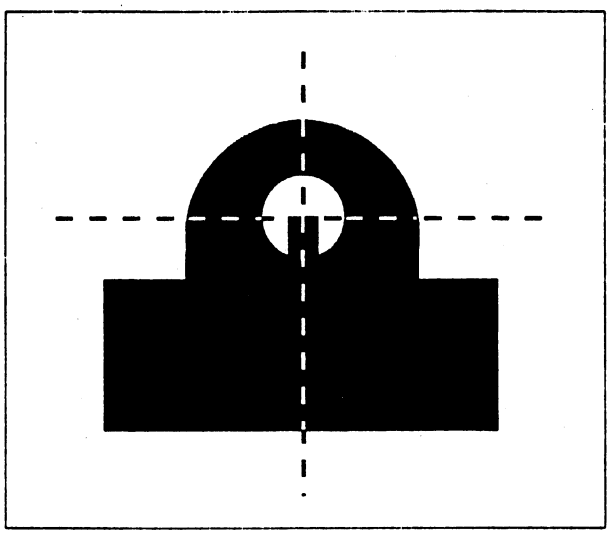


Fig 2-3. Sight alignment for 800 meters or less.

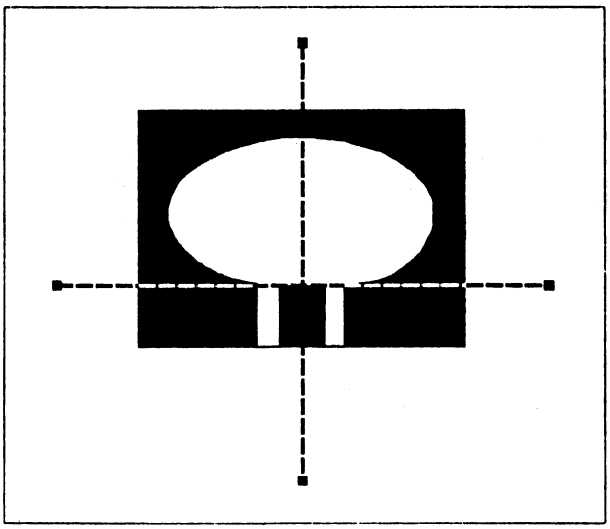


Fig 2-4. Sight alignment for 800 to 1800 meters.

2202. Sight Picture

Sight picture is the relationship between sight alignment and the placement of the aiming point on your target. The correct sight picture for the M240G machinegun is commonly referred to as "center mass." In other words, the point of aim is the point of impact if you have a correct sight picture. Figure 2-5 shows four examples of sight picture. Your sight picture should look like A, with the target directly in the middle of the sight. Can you see that the aim is too high in B? Can you see that the aim is too far to the left in C? Do you see that the aim is too low in D?

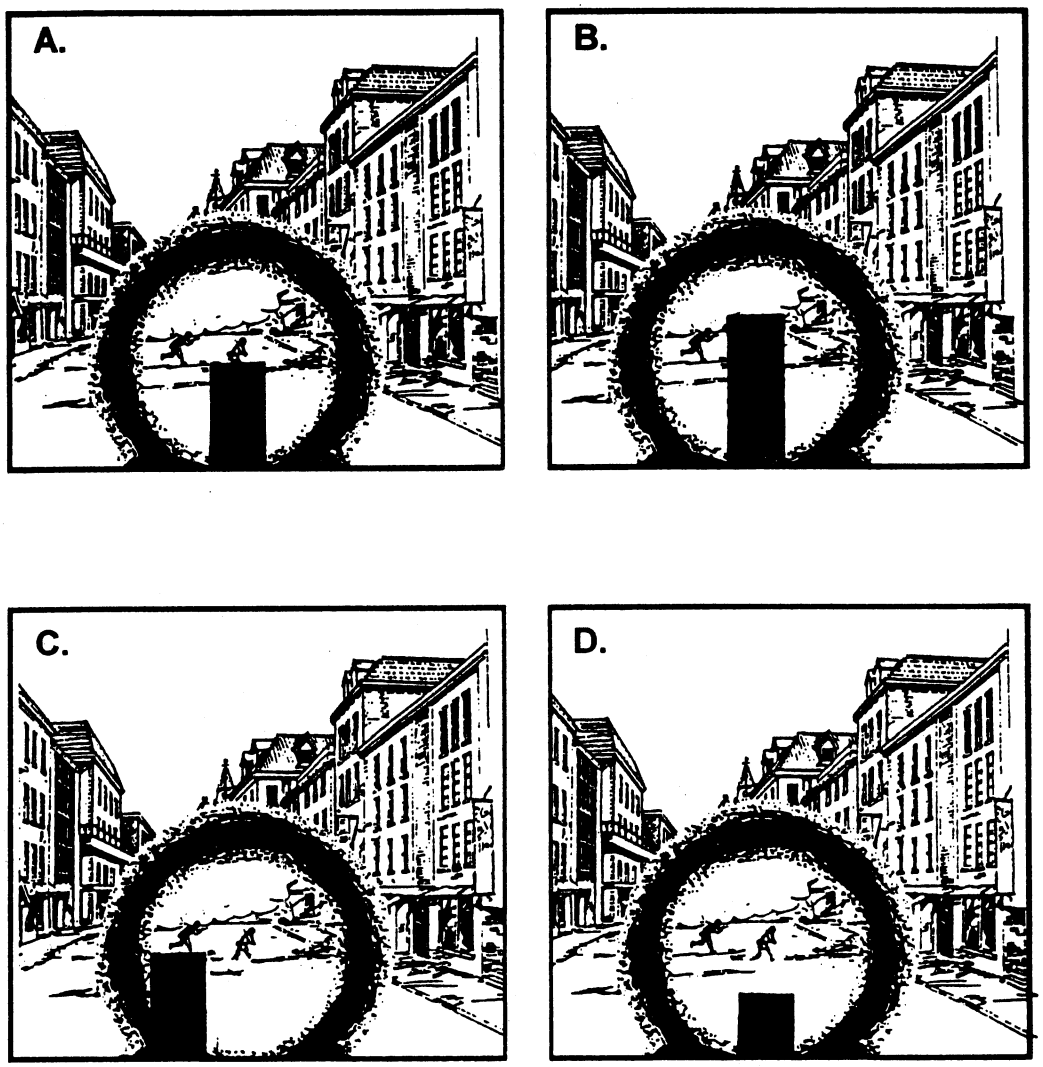


Fig 2-5. Four examples of the sight picture.

Do you recall the difference between sight alignment and sight picture? Did you remember that sight alignment is the front sight being aligned both vertically and horizontally in the rear sight? Did you recall that the sight picture is the picture you see when you align the rear and front sight at center mass on the target? If you answered correctly, you are ready to move on to the body firing position.

2203. Body Firing Positions

a. Body position set up. How you position your body behind the machinegun is important. Remember, the team leader will be in the prone position along your left side. You should position yourself to allow easy access to the barrel latch, safety, rear sight, and feed port. You should lie in the prone position with your right shoulder against the gun stock. An imaginary line should run from the muzzle, through the gun stock, through your right shoulder, through your right hip, and straight on through your right foot.

(1) Place your left hand, with the thumb inboard and the palm down, on the traversing and elevating (T&E) mechanism.

(2) Place your right hand on the trigger housing and use it to manipulate the trigger. You will also use your right hand to cock the gun and to use the safety, as required.

b. Body position when firing. As you pull the trigger to the rear, apply firm, equal pressure with both hands; avoid applying left or right pressure. This action is called "cross pressure" and is used in an attempt to take up some of the slack found in some T&Es. However, it is very difficult to manipulate the T&E with cross pressure. Further, it is difficult for an individual to maintain consistent, even cross pressure over time.

2204. 12.7 Meter Zeroing

Note: Before firing the M240G, inspect the buttstock for cracks. If the buttstock is cracked, **DO NOT FIRE THE GUN**. Notify the armorer.

a. Determine range. To zero the M240G machinegun, you must know your range is approximately 12.7 meters from the firing position to the target. (At the 12.7 meter range, the ordinate of the bullet is the same as it is at 500 meters.)

b. When and how to zero. Zeroing can be done in conjunction with qualification firing or by itself. You can construct a target or targets by using some type of wooden apparatus and sheets of paper with 1-inch black squares drawn on it. Mount the gun to the tripod and sandbag the feet of the tripod to ensure maximum stability.

c. Steps for zeroing the M240G machinegun on a 12.7 meter range

(1) Leave the front sight in its present position.

(2) Set the rear sight elevation slide to 500 meters.

(3) Using the T&E, manipulate the gun so you have good sight alignment and sight picture on the 1-inch black square. Ensure the T&E screws on the front sight post are centered.

(4) Load a single round of ammunition. Fire, ensuring you have sight alignment and sight picture for each shot.

(5) Observe the impact of the round you fired. If the shot is either above, below, left, or right of the aiming point, you must make adjustments to the front sight.

Note: Apply two or three drops of CLP around the base of the front sight to make it easier to rotate.

(6) Inform the team leader of the mechanical changes needed on the front sight. **Do not move the T&E.** See table 2-2.

Note: Always ensure the gun is in Condition 4 when mechanical changes are made on the front sight!

Table 2-2. Front Sight Adjustment

If the shot group is	Then	Formula
Above the aiming point	Rotate the front sight counterclockwise	At 12.7 meters, 1/2 turn equals 1/5 inch; 1 turn equals 3/8 inch
Below the aiming point	Rotate the front sight clockwise	At 12.7 meters, 1/2 turn equals 1/5 inch; 1 turn equals 3/8 inch
Inside the aiming point	Continue to confirm BZO	N/A
To the right of the aiming point	Move the front sight protector to the right	At 12.7 meters, one turn equals 1/3 inch
To the left of the aiming point	Move the front sight protector to the left	At 12.7 meters, one turn equals 1/3 inch
Centered in the aiming point	Continue to confirm BZO	N/A

(7) Using the T&E, relay the machinegun for correct sight alignment and sight picture on the black square.

(8) Load another round of ammunition. Fire, ensuring you have sight alignment and sight picture for each shot.

(9) Repeat steps (3) through (8) until you have fired a shot that strikes the center of the square. Once the round hits the center of the black square, fire a three-round burst and confirm zero. Your primary barrel is zeroed. (See paragraph 2206 for discussion of zeroing the spare barrel.)

2205. Field Zeroing on a Distant Aiming Point

a. When to field zero. Marines often find themselves in situations where it is not feasible to zero their machinegun on a paper target, so they must use the field zeroing method, also referred to as "distant point zeroing." This method requires you to **apply all safety precautions.**

b. How to field zero. To accomplish field zeroing, you need a target between 300 and 700 meters away. This target should be level with the firing position and have a physical mass, such as a hill, behind it. This allows you to observe the impact of the bullets. You must know the length of the range to the nearest 50 meters. Use either the pacing method or the map study method (taught in study unit 3, lesson 2, "Range Estimation"). Do not measure the range by any other range estimation method unless both the pacing method and map study method are not feasible. The machinegun must be mounted on the tripod.

c. Steps to field zero the 240G on a distant aiming point

(1) Set the rear sight to the correct range.

(2) With the T&E as close to being centered as possible, lay the gun on target and obtain sight alignment and sight picture. After you have obtained correct sight picture, you do not need to use the rear sight while firing.

(3) Load a six-round belt of ammunition and fire a six-round burst. **FREEZE!** Do not move the gun! If you move instead of freezing, the adjustments given to you by the team leader will not put the bullets on target.

(4) As directed by your team leader, manipulate the T&E to make needed corrections in relation to your first shot group. Use the rule of thumb below.

Rule of Thumb: **Push Right Up** and **Pull Left Down.**

(a) Elevation

1. Push right for up. Push the elevation handwheel with your left thumb to move the strike of the round up.

2. Pull left for down. Pull left with your left thumb to move the strike of the round down.

(b) Traversing

1. Push up on the traversing handwheel with your left thumb to move the strike of the round to the right.

2. Pull down on the traversing handwheel to move the strike of the round to the left.

(5) Load and fire another six-round burst. **FREEZE**.

(6) Make the corrections given to you by the team leader.

(7) Repeat the firing steps (steps 2 through 4) until your bullets impact on the point of aim.

(8) Inform the team leader which mechanical changes to make on the front sight until you achieve a good sight picture on the point of aim as you look through the rear sight.

(9) Fire a confirmation burst. If the bullets do not impact on target, repeat steps 3 through 8.

(10) If the bullets hit the target, lock the retaining strap and check for play in the front sight assembly. Your machinegun is now zeroed.

Note: If the front sight moves and is loose, this means you have play in your front sight. Notify your armorer.

2206. Zeroing the Spare Barrel

a. Purpose. A common mistake is forgetting to zero the spare barrel. Sooner or later you will need to change barrels. If you fail to zero the spare barrel, you will not be able to achieve your goal of putting "continuous and accurate fire on the enemy." It would be disastrous to lose fire superiority with your unit exposed! You can avoid this by simply remembering to zero the spare barrel after zeroing the main barrel.

b. Steps to zero the spare barrel

(1) After zeroing the primary barrel, change barrels. Be sure you do not change the data on the T&E.

(2) Load and fire either a three- or six-round burst at the target and **FREEZE!** The number of rounds you load and fire and the method of firing you use will depend on whether you are field zeroing (6 rounds) or 12.7-meter zeroing (3 rounds).

(3) Inform the team leader which adjustments to make on the front sight until you achieve a good sight picture on the center of your shot group.

(4) Relay the gun on your target and fire again.

(5) Repeat steps 2 through 4 until confirming hits have been made at the point of aim. When bullets are impacting at the point of aim, the spare barrel is zeroed.

Lesson Summary. This lesson covered sight alignment, sight picture, body firing positions, and different methods of zeroing the M240G machinegun, including 12.7-meter zeroing and field zeroing on a distant aiming point. In the next lesson we explore engaging targets using the AN/PVS-4 night sight.

Lesson 3. TARGET ENGAGEMENT USING THE AN/PVS-4 NIGHT VISION SIGHT

LEARNING OBJECTIVES

1. On an illustration, identify indicated components of the AN/PVS-4 night vision sight.

2. Match the controls on the AN/PVS-4 night vision sight with their function.

3. Given a partial list of steps for mounting the AN/PVS-4 night vision sight on the M240G machinegun, fill in the missing steps.

4. On an illustration of the reticle pattern of the AN/PVS-4 night vision sight with a target in the view, identify the correct range estimation and the correct aiming point.

5. Given a partial list of steps for adjusting the AN/PVS-4 night vision sight for vision, fill in the missing steps.

6. On an illustration of a 25-meter boresight target, identify the aiming point and impact point desired when boresighting the M240G machinegun mounted with the AN/PVS-4 night vision sight.

2301. AN/PVS-4 NVS Provides Advantage

When deployed into a combat situation as part of a Marine Expeditionary Unit or Brigade, you will enjoy very few tactical advantages. However, ~~United~~ States military forces do have one tactical advantage over many ~~of our~~ potential opponents--technology. Night vision devices are one area of technology directly related to machinegunners. To fully exploit your technological advantage, you must become proficient with all available night vision devices.

2302. AN/PVS-4 Components and Controls

Figures 2-6 and 2-7 show the components of the AN/PVS-4. Descriptions of the functions of some of the components are provided below. As you read the descriptions, study figures 2-6 and 2-7 to note the location of that component.

a. On-off reticle brightness control knob. Use this knob to turn power on and off and to adjust reticle image brightness. Since excessive reticle brightness may damage the sight, adjust knob so the pattern is clearly visible while using the lowest level of brightness required.

b. On-off tube brightness control knob. Use this knob to turn the power on and off and to adjust the brightness of the images seen through the sight. Adjust the image brightness to obtain the best contrast between your target and the background around it.

c. Eyepiece assembly. The eyepiece opens when you place pressure on the end of it and closes when you withdraw pressure. This design helps you maintain light discipline.

d. Diopter focus ring. Turn the diopter focus ring until you get the clearest image of the recticle pattern. Rotate this ring the same way you would manually focus a camera.

e. Objective focus ring. Turn the objective focus ring until the target is sharply defined in the sight picture. Rotate this ring the same way you would manually focus a camera.

f. Reticle elevation adjustment actuator (knob). Use this knob the same way you use the adjustable elevation scale and elevation knob on the M16A2 rear sight to zero the gun.

g. Reticle azimuth adjustment actuator (knob). Use this knob the same way you use the windage knob on the rear sight to zero the gun. Remember, once zeroed, the gun is only zeroed for the barrel that is currently in the gun.

h. Daylight cover. With this device you can operate the sight during daylight without damaging the sight. Remove the cover during darkness. To adjust the amount of light coming into the sight, rotate the center of the cover. If you operate the sight during daylight, turn the tube brightness control all the way down and adjust the brightness by using the daylight cover.

i. Battery caps. Remove battery caps for access to the batteries. Insert batteries into battery caps negative end first.

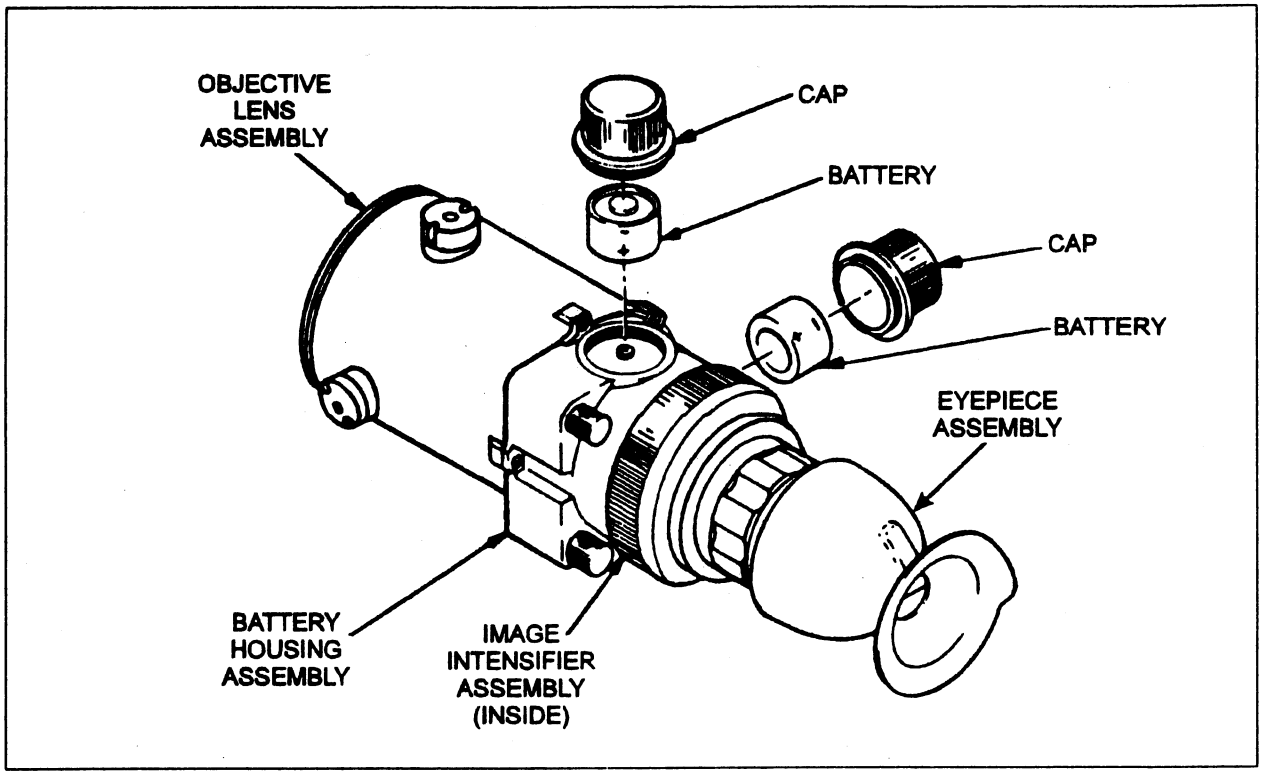


Fig 2-6. Top left side view of AN/PVS-4.

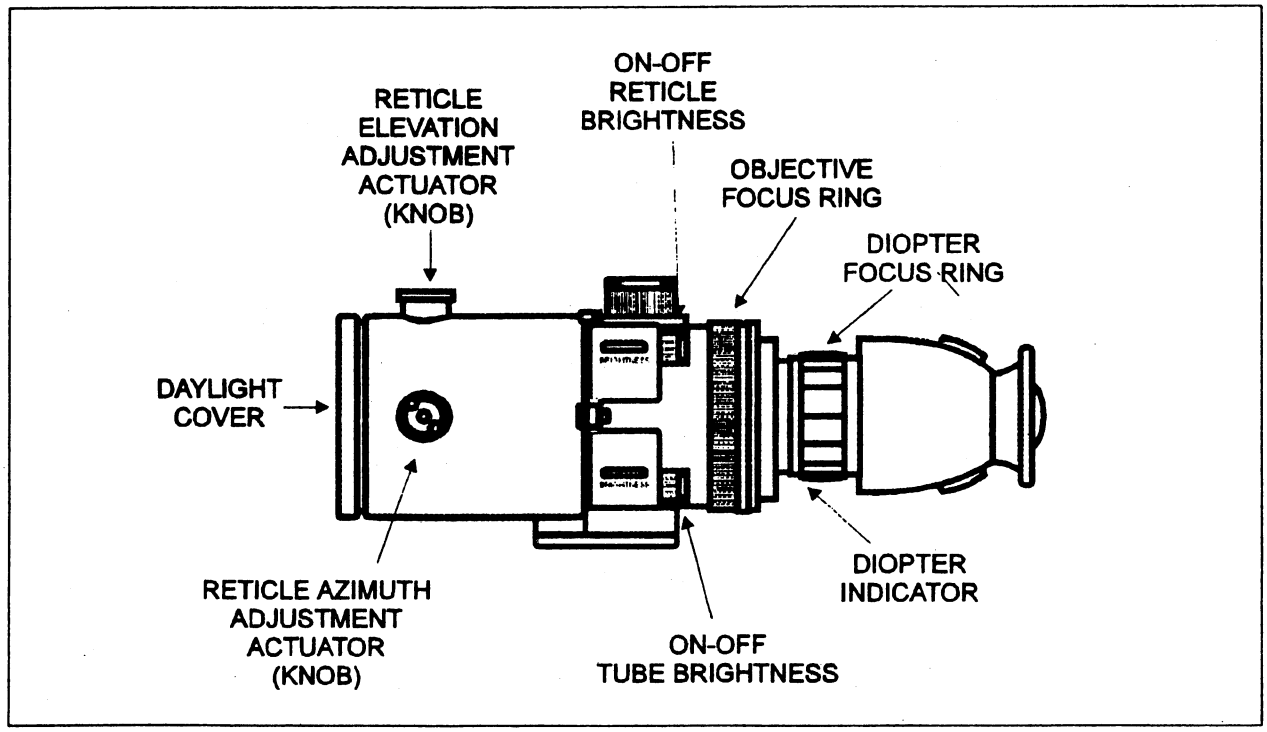


Fig 2-7. Left side view of AN/PVS-4.

2303. Mounting the AN/PVS-4 on the M240G

a. Two-phase process. Mounting the AN/PVS-4 night vision sight on your M240G machinegun is a two-phase process.

(1) Phase One: The armorer attaches the mounting bracket to the night vision sight.

(2) Phase Two: You mount the sight on the rail on the feed tray cover. Once you have the night sight with the mounting bracket attached, you complete the procedure by mounting the sight on the bracket.

b. Steps for mounting. To mount the AN/PVS-4 night vision sight on the rail, you must complete these steps:

(1) Position the sight mounting bracket on the feed tray cover and center over the rail (see fig 2-8).

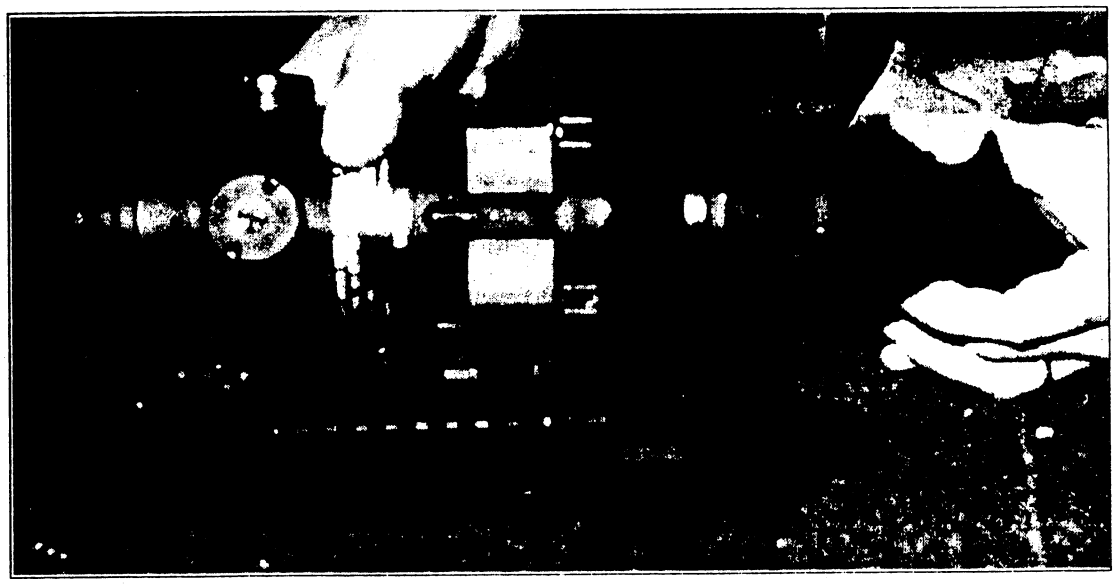


Fig 2-8. Positioning the sight mounting bracket.

Fig 2-9. Locking sight on mounting bracket.

(2) Lock the sight on the mounting bracket by pushing the two levers inward to tighten (see fig 2-9). Check the night vision sight to ensure it is seated securely.

2304. AN/PVS-4 Reticle Patterns

a. General overview. The AN/PVS-4 night vision sight can be fitted with several different reticle patterns. However, each weapon has its own reticle pattern. Therefore, it is critical for you to mount a sight on your weapon that contains the correct reticle pattern. If you mount a sight on your weapon that contains the wrong reticle pattern, the aiming points for different ranges will not correspond to the impacts of the bullets, even if you have zeroed the sight.

b. Two parts. Figure 2-10 shows an AN/PVS-4 reticle pattern for a 240G. Notice that the reticle pattern for the AN/PVS-4 has two parts:

- The upper part is a range estimation scale.
- The lower part (in the center) is a set of aiming points.

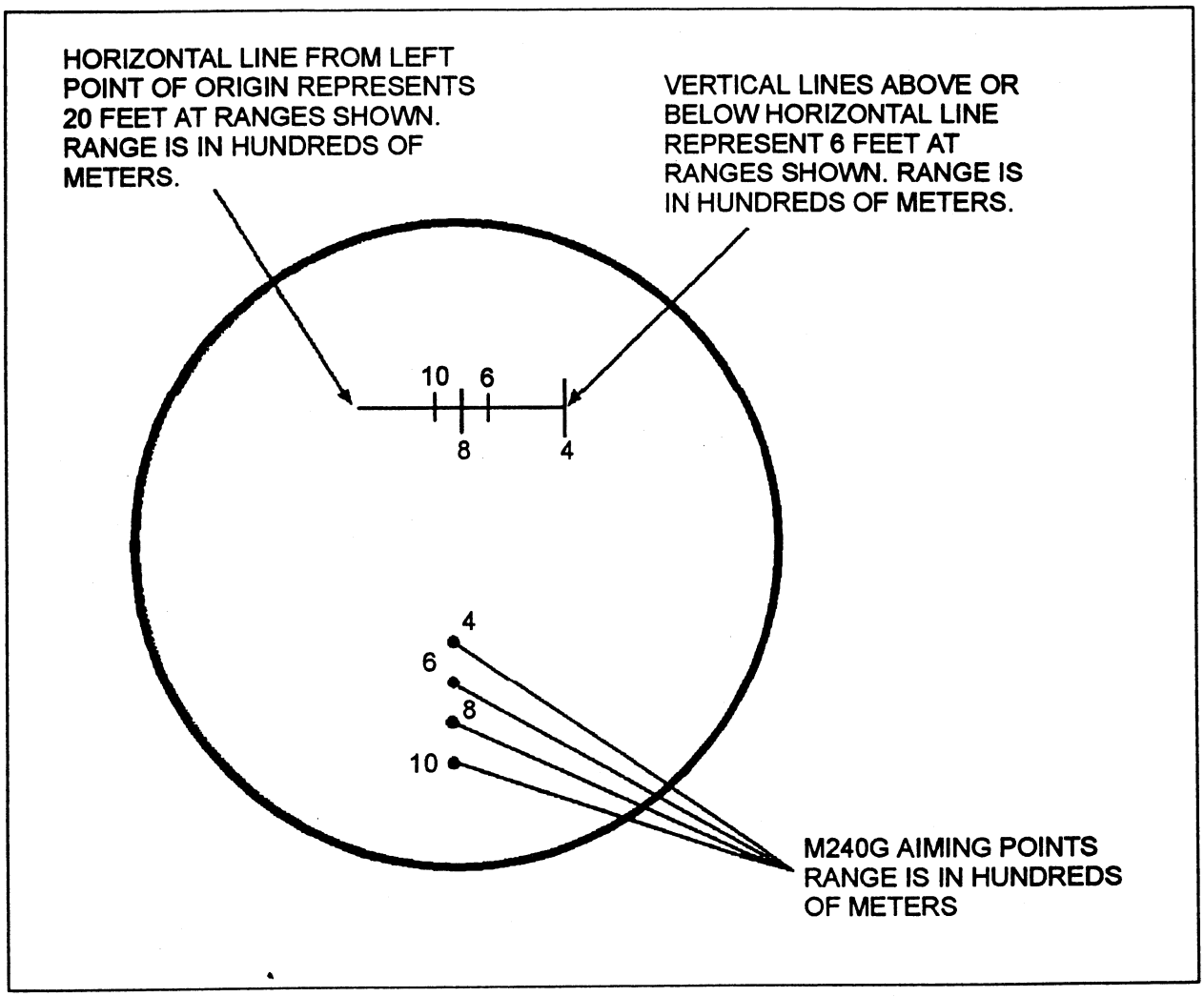


Fig 2-10. AN/PVS-4 reticle pattern for M240G machinegun.

(1) Range estimation scale. The upper part of the reticle is the range estimation scale. Using this scale, you can make relatively accurate range estimates based on the size of objects both horizontally and vertically. To estimate range with the range estimation scale, you must superimpose the range scale over the image of the object being used for the estimate, then align the appropriate index line based on the size of the object.

(a) Range estimates derived from vertical distance. Range estimates derived from vertical distance are based on the vertical height of six feet, or the average height of a man. Look at figure 2-11 and see that the ranges are marked 400, 600, 800, and 1,000 meters, or 4, 6, 8, and 10. At these ranges, the vertical distance is measured from the end of the vertical index line above or below the horizontal line to the horizontal line. For a range of 200 meters, you would measure the distance from the top of the first vertical index line to the bottom of that vertical index line. Additionally, 400 meters could be measured by the top or bottom half of the 400-meter index line, or the total length of the 800-meter index line.

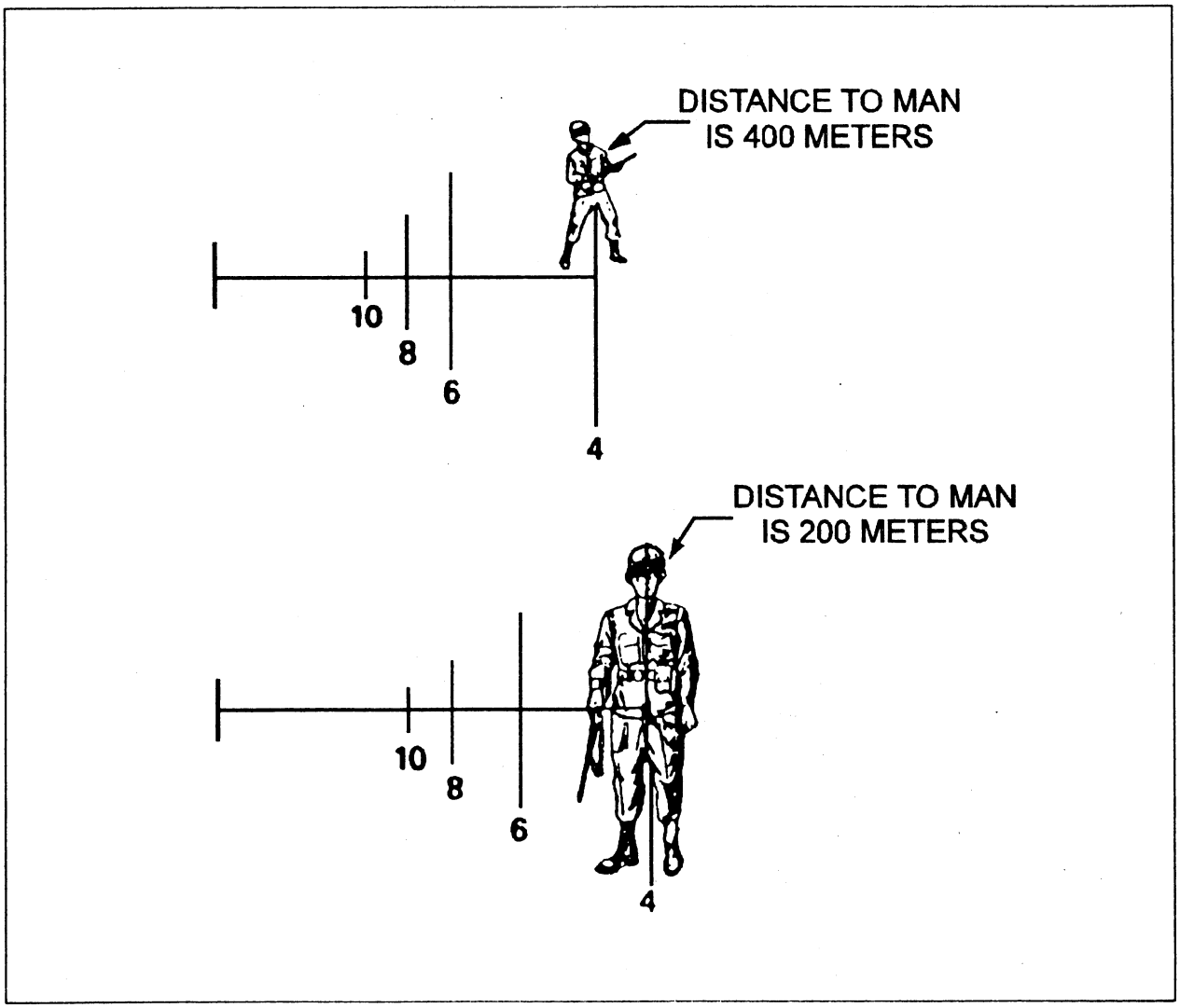


Fig 2-11. Range estimates based on vertical distance.

(b) Range estimates derived from horizontal distance are based on a horizontal length of 20 feet--the average length of most tanks and trucks. Study figure 2-12. Notice that lengths of horizontal distance are measured from the leftmost index line to the right. Note that if the length of the object is closer to 10 feet in length or width, you can still use it to base an estimate. Simply take half the range indicated.

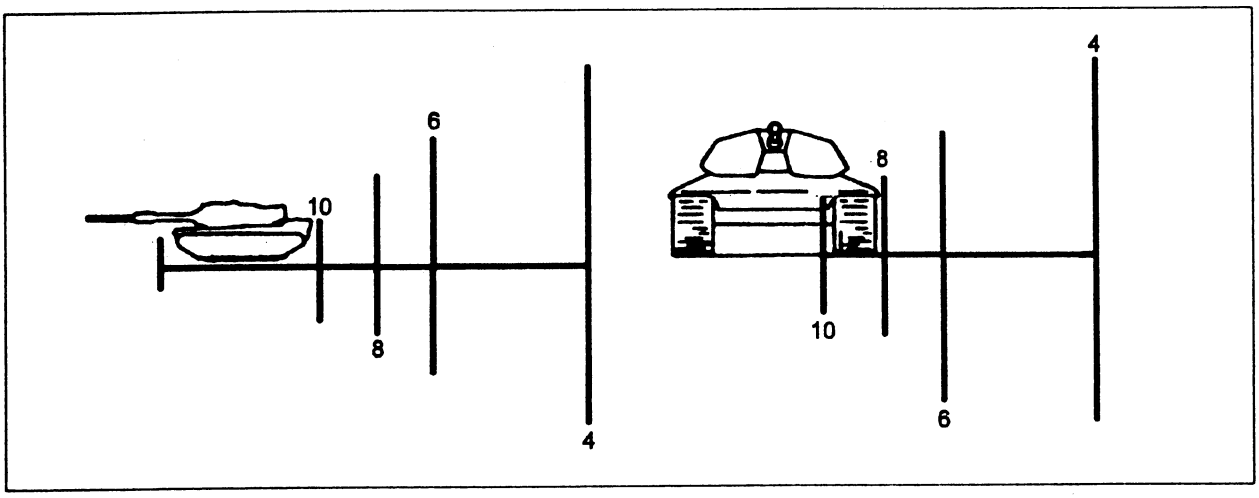


Fig 2-12. Range estimates based on horizontal distance.

(2) Aiming points. Once you have made your range estimate, you know which aiming point to use. Look at figure 2-13. Notice in the center of the reticle pattern for the M240G there are two short horizontal lines with four dots centered in a column under them. The area between the two lines is the aiming point for close ranges. The first dot is for ranges of 400 meters, the second dot is for ranges of 600 meters, the third dot is for ranges of 800 meters, and the final dot is for ranges of 1,000 meters.

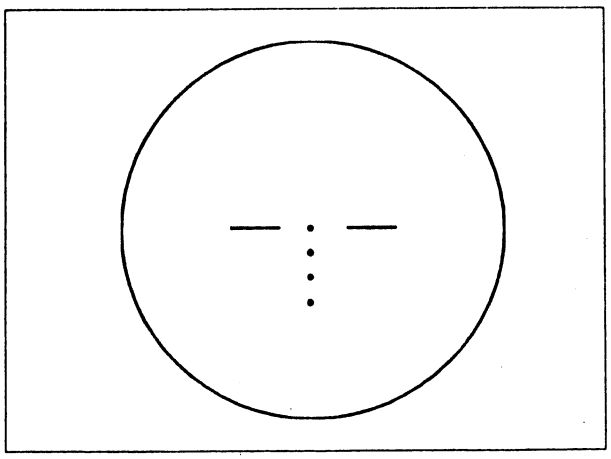


Fig 2-13. Aiming points.

c. Engaging targets. To engage a target with the M240G machinegun mounted with the AN/PVS-4 night vision sight, follow these steps:

(1) Turn on and adjust the sight for brightness. Focus of both the objective and the reticle pattern.

(2) Superimpose the range estimation scale over the object being used to make the range estimate and make as close an estimate as possible. You do not have to use the target you intend on engaging for the range estimate. You can use any object near the target as long as it is approximately the same distance from you as the target.

(3) Select the correct aiming point. Then manipulate the gun until the aiming point is on target. Fire upon command.

2305. Adjusting for Vision

a. General. After you have correctly mounted the AN/PVS-4 night vision sight on your M240G, you must adjust it for proper vision. As you follow the steps below to adjust for proper vision, refer back to figures 2-6 and 2-7 to determine the location of the controls.

b. Steps to adjust for proper vision

(1) Press your eye against the eyepiece to open it. Maintain only enough pressure to keep it open.

(2) Turn the on-off tube brightness control knob clockwise. Adjust the brightness of the images to the lowest setting that provides the best target-to-background contrast.

(3) Turn the on-off reticle brightness control knob clockwise. Adjust the brightness of the reticle pattern to the lowest level that gives you a clearly visible pattern.

(4) Adjust the diopter focus ring until the reticle pattern is in the clearest possible focus.

(5) Adjust the objective focus ring until the target is in the clearest possible focus.

(6) Repeat brightness control adjustments after you complete focus adjustments. This will result in even lower brightness settings.

(7) When you have completed all adjustments, turn off both on-off control knobs until you are ready to engage a target. If you do this habitually, you will greatly increase your battery life.

2306. 25-Meter Zeroing the AN/PVS-4

a. Purpose. Even though you have correctly mounted and adjusted the AN/PVS-4 night vision sight on your M240G machinegun, it is like any other sight until zeroed--useless! You must zero the AN/PVS-4 night vision sight to your M240G machinegun.

b. Steps to zero the AN/PVS-4 night vision sight

Note: If you change barrels on your gun, your sight is no longer zeroed. However, if you anticipate extensive firing using the night sight, you can zero both barrels, record the difference in sight settings, and make the correction in sight setting each time you change barrels.

(1) With the AN/PVS-4 night vision sight mounted and adjusted for vision, and with your gun mounted on a tripod with T&E, assume the prone firing position.

(2) Fire several short bursts (4 to 5 rounds) into the impact area between targets to stabilize the sight in the mount, then retighten the mounting clamps.

(3) Using the T&E, manipulate the gun until you have a good sight picture using the space between the horizontal lines as your aiming point.

(4) Fire a short burst and freeze.

(5) After locating your shot group, inform your team leader of the adjustments needed on the azimuth control knob and elevation control knob until you have a good sight picture on a point that is 11.9 cm (this is the distance between the night vision sight and the iron-sights on the weapon) directly above the shot group.

(6) Relay on your aiming point using the T&E and fire another short burst.

(7) Repeat steps 4, 5, and 6 until you have achieved two consecutive shot groups that are approximately centered 11.9 cm directly below your point of aim. Your gun and sight are now zeroed.

2307. Field Zeroing the AN/PVS-4

a. General. Field zeroing the AN/PVS-4 to the M240G is another way of zeroing the night sight to the M240G. To use the field zeroing technique, the range estimate must be accurate.

b. Steps to field zero the AN/PVS-4 night sight

(1) Lay the weapon on the target.

(2) Load the weapon.

(3) Place the range aiming point on the target.

(4) Fire a three-round burst.

(5) Correct for windage and elevation as needed.

(6) Repeat steps 2 through 5 until zero is confirmed.

c. Engaging. After the AN/PVS-4 has been zeroed, the techniques to engage targets are the same as you have learned thoughout this course.

Note: For greater accuracy, zero your weapon at a distance between 400 and 600 meters. You will fire for point of aim/point of impact.

Lesson Summary. In this lesson we covered the components, controls, mounting of the AN/PVS-4 night vision sight, and how to zero and engage targets. The next lesson will cover taking immediate action while using the M240G machinegun.

Lesson 4. IMMEDIATE ACTION

LEARNING OBJECTIVES

1. Select the correct method of stopping a runaway gun.

2. Identify the sequence of steps used to correct a sluggish gun.

3. Identify the sequence of steps used to perform immediate action in case of a stoppage during firing of the M240G.

4. Select the correct method of extracting a stuck or ruptured cartridge.

2401. Malfunctions

a. Definition. A malfunction occurs when the gun fails to function satisfactorily. The gun fires, but improperly. The two most common malfunctions are runaway gun and sluggish operation.

(1) Runaway gun. Worn or broken parts in your machinegun can result in what is referred to as a runaway gun. In these situations, the gun will not stop firing when

you release the trigger. This is usually the result of a worn, broken, or burred sear. The sear shoulder is unable to grab the operating rod and hold it to the rear. An excessively worn sear notch on the operating rod could also be responsible. When the gun fired on a bipod, tripod, or pedestal mount, it may be stopped by performing the following steps in sequence.

(a) Keep the gun pointed in a safe direction and on target.

(b) If the gun has 50 rounds or less let the gun fire the remaining rounds out. If there is more than 50 rounds, either you or the team leader then must firmly grasp the ammunition belt and twist it. This will either cause a jam or will break the belt and allow only a few more rounds to be fired.

(c) Clear the gun by pulling the cocking lever to the rear and holding it there while the team leader removes any rounds from the feed tray and other parts of the receiver including the chamber.

Caution: **Do not attempt to put the gun back in action.**

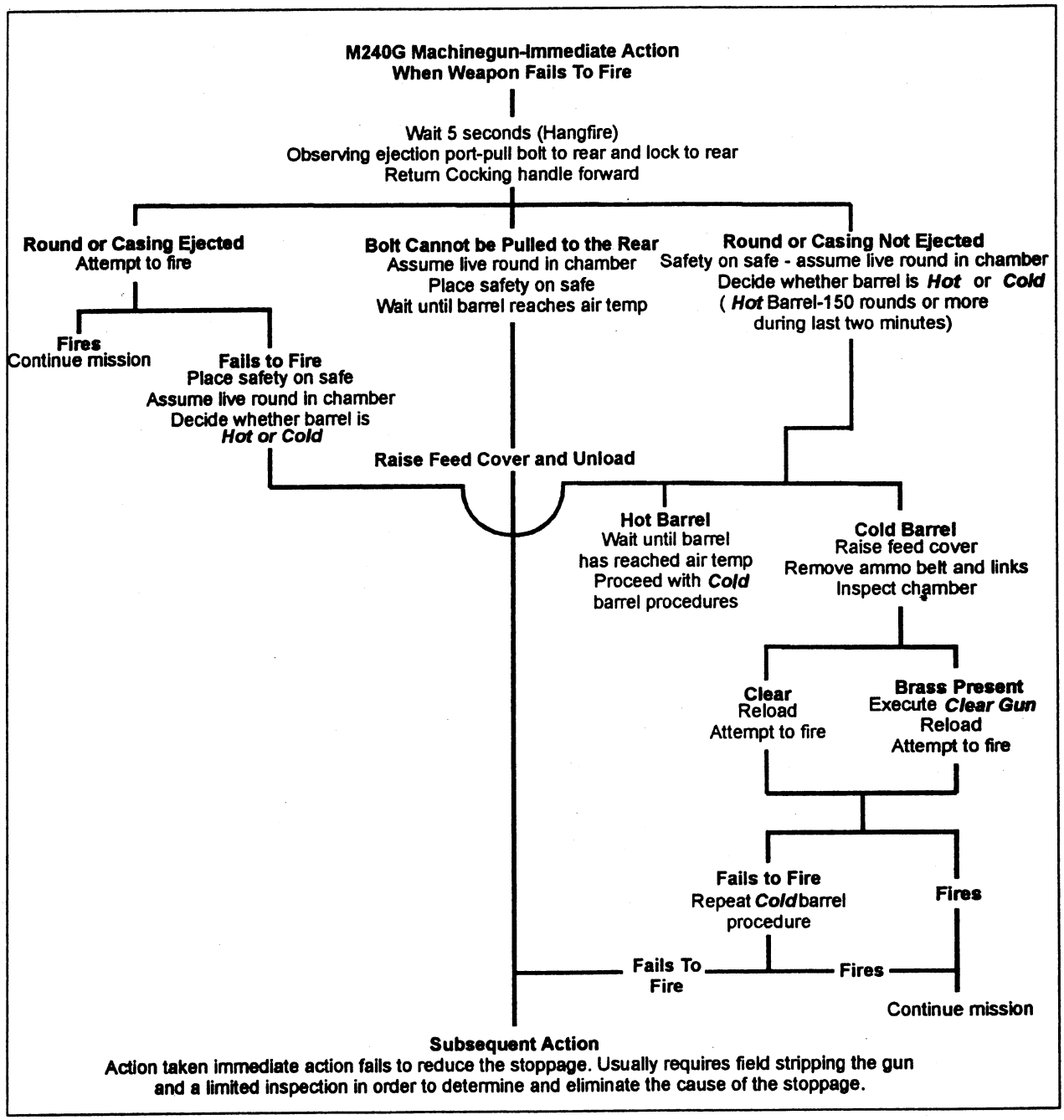
(d) Evacuate the gun to the armory personnel for repair or replacement.

(2) Sluggish operation. The gun was designed to fire at a normal rate (approximately 9 to 10 rounds per second); a sluggish gun will fire slower. Common causes for a sluggish operation are excessive friction, or a loss of gas. Excessive friction can be reduced by lubricating and cleaning the bolt and receiver rails. Excessive loss of gas is usually due to loose connections in the gas system. To remedy loss of gas, tighten and replace parts as required. If your weapon has built up carbon or dirt particles that reduces the normal rate of fire, move the regulator setting to the number 2 or 3 position, and leave it there. Once the gun fires at its normal rate again, and it's time to change barrels, ensure that the spare barrel's gas regulator is in the number 1 position.

2402. Stoppages

a. Immediate action. To maintain a continuous rate of fire, you must be able to quickly and efficiently clear stoppages that may occur. To clear a stoppage, you must perform appropriate immediate action. Look at table 2-3 on the following page. This is an immediate action table that presents a series of estimations of the situation followed by a decision to take one of two courses of action. The steps must be followed in proper sequence. If you fail to follow time intervals or the correct sequence, the result may be serious injury to yourself or others. Study table 2-3 on the next page.

Table 2-3. Immediate Action



b. Ruptured cartridge. Sooner or later you are bound to experience a ruptured cartridge that will cause a stoppage. A ruptured cartridge occurs when a round is fired and the back is blown off the back of the cartridge case. To extract a ruptured cartridge, follow the steps listed below:

(1) Pull the bolt to the rear.

(2) Place safety on fire ("F").

Note: If a live round is fed into the ruptured cartridge, remove the live round prior to step 3.

(3) Hold the cocking handle to the rear, squeeze the trigger, and ease the bolt forward until it stops.

(4) Remove the barrel.

(5) Push the threaded end of the extractor post through the ruptured cartridge case (see fig 2-14).

(6) Pull the handle of the extractor to remove the cartridge (see fig 2-14).

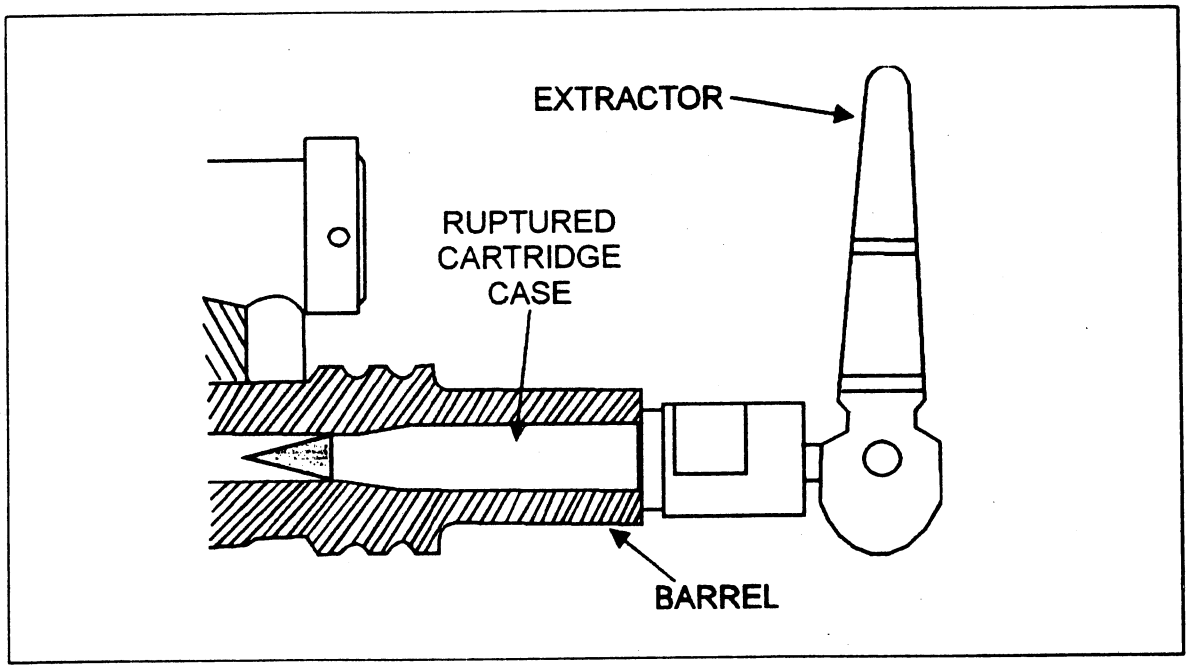


Fig 2-14. Ruptured cartridge removal.

Lesson Summary. This lesson covered taking immediate action for problems on the M240G, including misfires, stoppages, and removing ruptured cartridges. The next lesson covers procedures for changing the barrel.

Lesson 5. CHANGING THE BARREL

LEARNING OBJECTIVES

1. Identify from a list the times you should change barrels.

2. Identify the sequence of steps used to perform a barrel change while firing the M240G machinegun from the tripod or bipod.

2501. Changing the Barrel in Tripod or Bipod Mounts

a. General. The M240G machinegunner can quickly change the barrel of his gun regardless of whether it is mounted on a bipod or tripod and regardless of whether the bolt is forward or locked to the rear. This quick change capability of the M240G is a great advantage over older machineguns. It allows the operator to use one barrel while the other is cooling.

b. Procedures. It is important for you to learn and use the procedures for changing barrels. Using these procedures, you can change a barrel in only a few seconds. Changing barrels has two great advantages: it increases the life of the barrel and it ensures a rapid rate of accurate fire when you engage targets. How often and when should the barrels be changed? This question is often asked and the answer is often debated. However, publication MCWP 3-15 directs that barrels be changed at the following specific times:

(1) When the barrel becomes hot enough so that handling is difficult, and a lull occurs in the fighting, change the barrel regardless of the number of rounds fired.

(2) After firing at the cyclic rate for one minute, change the barrel.

(3) After firing the rapid rate for two minutes, change the barrel.

(4) After firing at the sustained rate for 10 minutes, change the barrel.

(5) After firing a long burst of continuous fire, change the barrel.

c. Barrel change on a tripod-mounted M240G. To change the barrel when the M240G is mounted on a tripod, follow the steps below:

Warning: Always remove a hot barrel by the carring handle!!!

(1) Gunner stops firing.

(2) Gunner places the weapon on safe. Gunner ensures the gun is stabilized by keeping his right shoulder behind the butt stock of the gun, as if firing.

(3) Gunner depresses the barrel-locking latch with his left hand, keeping his hand in that position until the spare barrel is seated.

(4) The team leader grasps the barrel by the changing handle and rotates it to its upright position, pushing forward and lifting it up from the receiver.

(5) The team leader grasps the spare barrel by the changing handle and inserts the spare barrel into the receiver while aligning the gas plug with the gas cylinder. The team leader then pulls the barrel to the rear until it is fully seated.

(6) The gunner releases the barrel release latch.

(7) The team leader lowers the barrel changing handle while counting the clicks. He ensures it has been tightened at least two clicks but not more than seven clicks to achieve proper alignment.

The gun is now ready to continue firing.

d. Barrel changes on a bipod-mounted M240G. Bipod-mounted barrel changes are the same as tripod-mounted barrel changes with one exception--the gunner must support the weapon with his left hand when the barrel is changed.

Note: If you lowered the changing handle less than two clicks or more than seven clicks, the barrel will not have the proper headspace. **Do not fire the weapon!** Firing a weapon without proper headspace could result in serious injury to the operator or damage to the gun. Notify an armorer.

Caution: The weapon may be loaded when you change barrels, **BUT you must place the weapon on SAFE ("S") !!**

Lesson Summary. This lesson covered the procedures for changing the barrels on the M240G and each team member's duties during barrel changing. Next is the study unit exercise.

Study Unit 2 Exercise: Complete items 1 through 28 by performing the action required. Check your responses against those listed at the end of this study unit.

Matching: For items 1 through 3, match the condition code in column 1 to its proper description in column 2.

Column 1		Column 2	
Condition Code			Description
___ 1.	Condition 1	a.	Ammunition in position on feed tray, chamber empty, bolt locked to the rear, and safety on safe ("S")
___ 2.	Condition 3	b.	Ammunition in position on feed tray, chamber empty, bolt forward, safety on safe ("S")
___ 3.	Condition 4	c.	Feed tray clear of ammunition, chamber empty, bolt forward, safety on safe ("S")

For items 4 through 11, circle the letter of the most correct answer.

4. Identify the correct seqence of steps used to load the M240G machinegun with the feed tray cover raised.

   1. Open the ammunition box.
   2. Place the first round in the feed groove of the feed tray against the cartridge stop.
   3. Locate the end of the ammunition belt and pull out the first few rounds with the tips pointed toward the muzzle and the solid part of the links facing up.
   4. Close the cover and ensure it latches firmly, without having to force it closed.

   a. 1, 3, 2, 4
   b. 3, 2, 1, 4
   c. 2, 1, 3, 4
   d. 1, 3, 2, 4

5. Identify the correct sequence of steps used to load the M240G machinegun with the feed tray cover closed.

1. The team leader feeds the first round into the feedway until the holding pawl engages it and holds it in place.

2. The team leader opens the ammunition box by tearing off the tab marked by the silhouette of a round.

3. The gunner pulls the cocking handle to the rear and ensures that the bolt has been engaged by the sear, then he returns the cocking handle to the forward position and places the weapon on safe.

4. The team leader locates the end of the ammunition belt and pulls out the first few rounds. He ensures that the rounds coming out of the box have the tips pointed toward the muzzle and the solid part of the links is facing up.

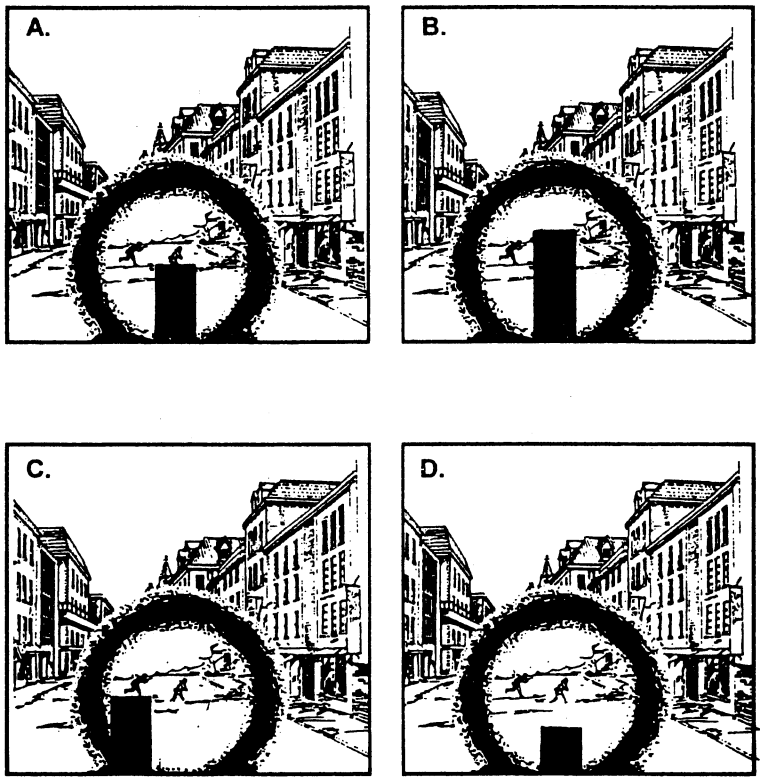
a. 2, 4, 1, 3
b. 2, 4, 1, 3
c. 4, 1, 2, 3
d. 2, 4, 1, 3

6. Identify the correct sequence of steps used to unload the M240G machinegun.

1. Remove the belt and any remaining links from the feed tray.
2. Cease fire and keep the weapon pointed down range and in a safe direction.
3. Squeeze the cover latches and raise the feed tray cover.
4. Pull the cocking handle to the rear and ensure that the bolt has been engaged by the sear, then return the cocking handle to the forward position.
5. Lift the feed tray and visually inspect the chamber, ensuring the gun is clear.
6. Place the weapon on safe.

a. 1, 2, 3, 4, 5, 6
b. 6, 2, 3, 4, 5, 1
c. 2, 6, 3, 1, 5, 4
d. 2, 4, 6, 3, 1, 5

7. Identify the illustration with the correct sight alignment and sight picture for the M240G machinegun.



8. Identify the description of the correct firing position for the gunner and the team leader when firing the M240G machinegun.

   a. The gunner lies in the prone position with his right shoulder against the gun stock. He places his left hand on the T&E and his right hand on the trigger housing. The team leader lies in the prone position along the left side of the gunner.

   b. The gunner lies in the prone position with his left shoulder firmly against the gun stock. He places his right hand on the T&E and his left hand on the trigger housing. The team leader lies in the prone position along the right side of the gunner.

   c. The gunner lies in the prone position with his right shoulder against the gun stock. He places his right hand on the T&E and his left hand on the trigger housing. The team leader lies in the prone position along the left side of the gunner.

   d. The gunner lies in the prone position with his right shoulder against the gun stock. He places his left hand on the T&E and his right hand on the trigger housing. The team leader lies in the prone position along the right side of the gunner.

9 Select the correct sequence of steps used to zero the M240G machinegun on the 12.7 meter range.

1. Observe your shot group and direct the team leader to manipulate the front sight.
2. Load three rounds, aim in and fire three well-aimed single shots at the black spotter.
3. Using the T&E, relay the gun on the black spotter.
4. Set the rear sight elevation slide to 500 meters.
5. Repeat the procedures until you have fired a shot group that strikes the center of the spotter.

a. 4, 2, 3, 5, 1
b. 3, 4, 2, 1, 5
c. 4, 3, 2, 1, 5
d. 4, 3, 1, 2, 5

10. Select the correct sequence of steps to field zero the M240G machinegun on a distant aiming point.

1. Using the T&E, lay the gun on target.
2. Fire a six-round burst, then freeze!
3. Set the rear sight elevation slide to the correct range.
4. Fire another six-round burst, then freeze!
5. Fire a confirming burst.
6. Direct the team leader in manipulating the front sight until a good sight picture is obtained on the target.
7. As directed, manipulate the T&E to make corrections for the amount of error in your bursts' impacts.
8. Repeat firing and adjusting until impacts are observed on the target.
9. Once a confirming burst hits target, lock retaining strap, and check for slack.

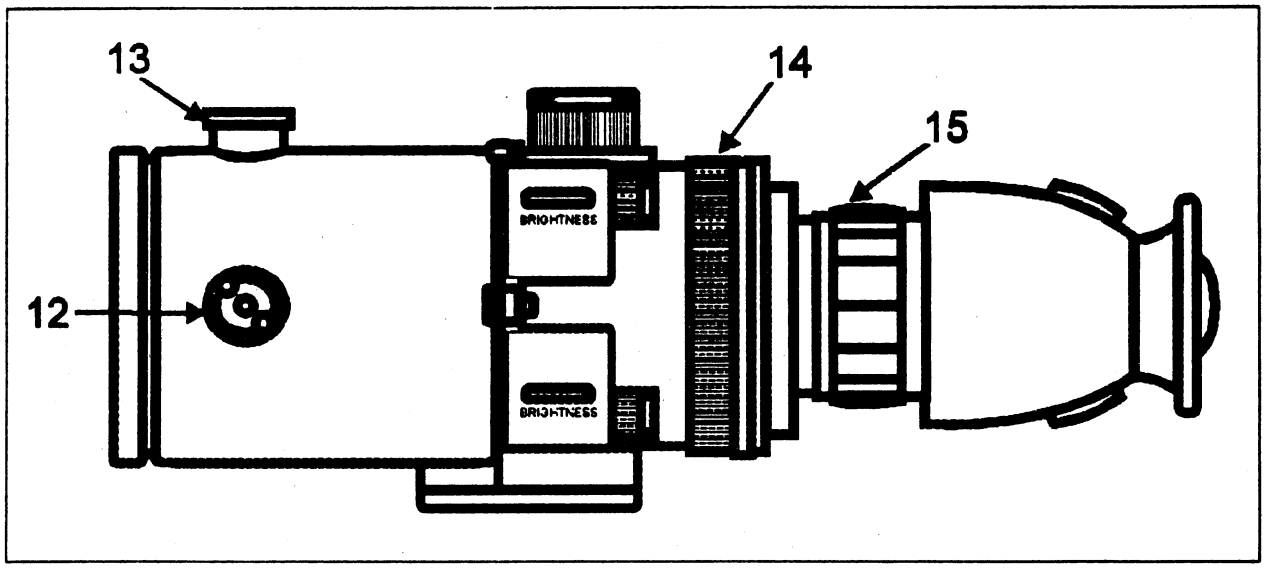
a 1, 2, 3, 5, 4, 6, 7, 8, 9
b. 3, 2, 1, 4, 5, 6, 8, 7,
c. 3, 1, 2, 6, 4, 7, 8, 5, 9
d. 3, 1, 2, 4, 9, 8, 5, 6, 7

11. Select the correct procedure for zeroing the M240G machinegun's spare barrel.

1. Repeat firing and adjusting until confirming hits have been made at the point of aim.
2. Load and fire at the target and freeze.
3. Relay on the target and fire again.
4. Direct the team leader to adjust the front sight until you have obtained a good sight picture on the center of your shot group.

a. 2, 4, 3, 1
b. 2, 3, 4, 1
c. 4, 2, 3, 1
d. 1, 4, 3, 2

Matching: For items 12-15, use the illustration of the AN/PVS-4 night vision sight provided below. In the illustration, four numbers point to four components. Match the number of each component in the illustration (column 1) with its correct name (column 2).



Column 1		Column 2	
Component Number		Component Name	
___	12. Item 12 in illustration	a.	Objective focus ring
___	13 Item 13 in illustration	b.	Azimuth actuator knob
___	14. Item 14 in illustration	c.	Diopter focus ring
___	15. Item 15 in illustration	d.	Elevation actuator knob

Matching: For items16 through 20, match each AN/PVS-4 night vision sight control listed in column 1 with its function listed in column 2.

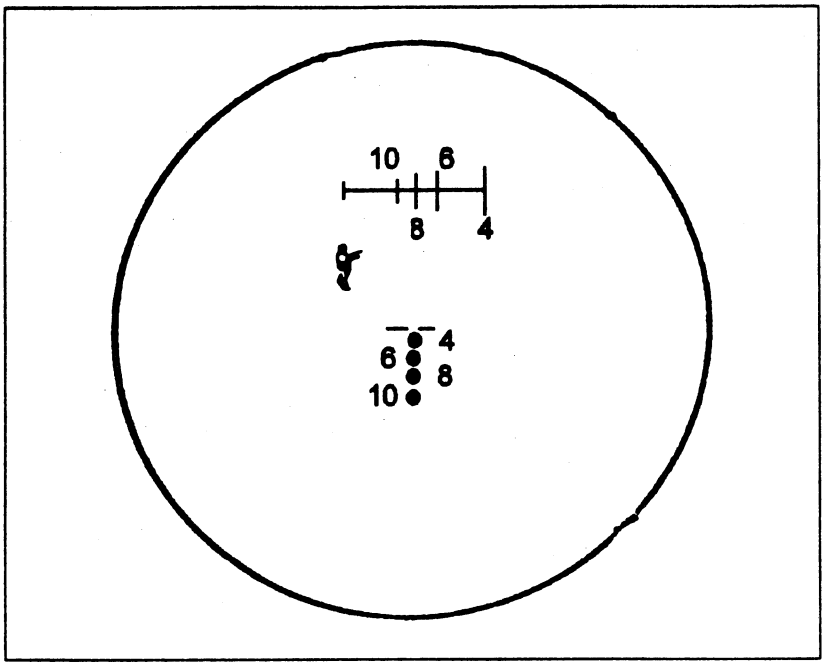
Column 1		Column 2	
Control		Function	
___	16. On-off reticle brightness control knob	a.	Used to focus the reticle pattern into a sharp image
___	17. On-off tube brightness control knob	b.	Used to focus the image of your target/objective
___	18. Eyepiece	c.	Used to turn the power on and off, in addition to adjusting the brightness of the reticle image
___	19. Diopter focus ring		
___	20. Objective focus ring	d.	Designed to open when you place pressure on the end of it
		e.	Used to turn the power on and off and to adjust the brightness of the direction images seen through the sight

Identification: For items 21 through 28, circle the letter of the most correct answer.

21. Mounting the AN/PVS-4 night vision sight on your M240G is a two-phase process. In the first phase, _____ will attach the mounting bracket to the night vision sight. In the second phase, _____ will mount the sight on the rail on the feed tray cover.

a. the armorer; the ammunition bearer
b. you; you
c. the ammunition bearer; you
d. the armorer; you

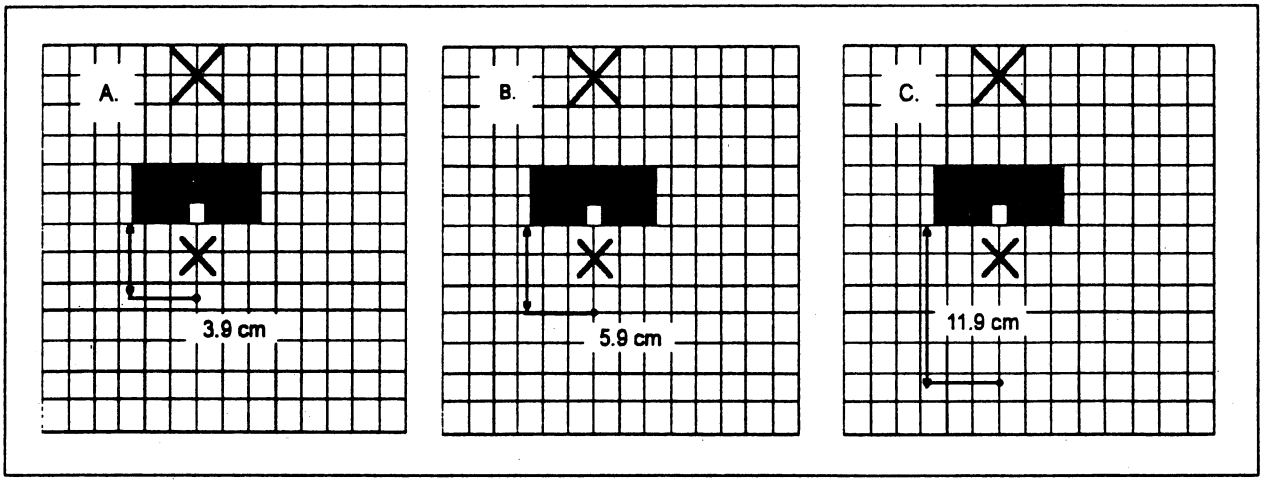
22. Below is an illustration of the reticle pattern of the AN/PVS-4 night vision sight with a target in the view. Indentify the correct range estimation and correct aiming point.



a. 600 meters/second dot down
b. 300 meters/second dot down
c. 500 meters/fourth dot down
d. 1000 meters/fourth dot down

23. Below are three illustrations showing three 25-meter boresight targets. Identify the <u>desired</u> aiming and impact points when boresighting the AN/PVS-4 night vision sight on an M240G machinegun.

a. b. c.



24. Select the correct method of stopping a runaway gun.

a. Keep the weapon pointed in a safe direction and stick the end of a cleaning rod into the ejection port.
b. Keep the weapon pointed in a safe direction, then twist and break the ammunition belt.
c. Keep the weapon pointed in a safe direction; pull the cocking lever to the rear and hold it.
d. Keep the weapon pointed in a safe direction and rapidly squeeze and release the trigger.

25. Indentify the correct sequence of steps to correct a sluggish gun.

a. Lubricate.
Check for loose connections.
Change barrel.
Stop firing.

b. Lubricate.
Check for loose connections.
Change regulator setting.
Change barrel.

c. Lubricate.
Change regulator setting.
Change barrel.
Check for loose connections.

d.. Lubricate.
Change regulator setting.
Change battery.
Check for loose connections.

26. If the weapon still fails to fire after performing immediate action, what is the next step to take?

a. Notify the armorer.
b. Perform subsequent action.
c. Change barrel.
d. Change ammo.

27. Identify the sequence of steps used to extract a ruptured cartridge from the M240G machinegun.

1. Remove the barrel.
2. Push threaded end of the extractor post through the ruptured cartridge case.
3. Hold the cocking handle to the rear, squeeze the trigger, and ease the bolt forward until it stops.
4. Place safety on fire ("F").
5. Pull the bolt to the rear.
6. Pull on the handle of the extractor to remove the cartridge.

a. 4, 1, 2, 3, 6, 5
b. 4, 5, 1, 3, 6, 2
c. 5, 4, 3, 1, 2, 6
d. 5, 3, 4, 1, 2, 6

28. Identify the sequence of steps used to perform a barrel change while firing the M240G machinegun.

1. Lock the barrel into the receiver and lower changing handle, ensuring that it is tightened between 2 and 7 clicks.
2. Pull the cocking lever to the rear and place the gun on safe.
3. Release the barrel lock.
4. Remove the current barrel and set it aside.
5. Stop firing.
6. Insert the cold barrel into the barrel socket.

a. 5, 2, 4, 3, 1, 6
b. 5, 1, 2, 6, 3, 4
c. 5, 4, 2, 3, 6, 1
d. 5, 2, 3, 4, 6, 1

Study Unit 2 Exercise Solutions

		Reference
1.	a.	2101
2.	b.	2101
3.	c.	2101
4.	a	2102
5.	b	2102
6.	d	2103
7.	a.	2202
8.	a	2203
9.	c	2204
10.	c.	2205
11.	a	2206
12.	b	2302
13.	d.	2302
14.	a	2302
15.	c	2302
16.	c.	2303
17.	e.	2303
18.	d.	2303
19.	a	2303
20.	b	2303
21.	d	2304
22.	a	2305
23.	c	2307
24.	b	2401
25.	b	2401
26.	b	2402
27.	c	2402
28.	d	2501

UNIT SUMMARY

In this study unit, you learned to identify the steps used to load the M240G machinegun with the feed tray cover closed or raised. You learned to identify the steps to unload the M240G and the applicable condition codes. You also learned to identify the correct sight alignment and sight picture for the M240G. In addition, you learned how to identify the correct firing positions for the gunner and team leader when firing the M240G. You now know how to select the correct sequence of steps to zero the M240G on a 12.7 meter range and to field zero the M240G on a distant aiming point. You now know how to use the AN/PVS 4 night vision scope, the steps to perform immediate action during firing of the M240G, the correct times to change barrels, and the steps to perform a barrel change while firing the M240G. This is a lot of information, but you should know it and remember it before proceeding. In study unit 3, you will learn to identify classes of fire, estimate range, and give commands to your machinegun team.

STUDY UNIT 3

TECHNIQUES OF FIRE

Introduction. Engaging targets effectively requires that you know the characteristics of each class of fire. If you want to efficiently engage targets, it is not enough to have a zeroed weapon and apply good marksmanship. Effectiveness is achieved by using the proper class of fire while engaging targets. And remember, your targets will not always be directly to your front.

Lesson 1. IDENTIFYING CLASSES OF FIRE

LEARNING OBJECTIVES

1. Match the general terminology of machinegun fire with its definitions.
2. Identify the classes of machinegun fire in relation to the ground.
3. Identify the classes of machinegun fire in relation to the machinegun.
4. Identify the classes of machinegun fire in relation to the target.

3101. General Terminology

Technique of fire is defined as the application of those methods and principles necessary to engage and destroy the target with minimal time and ammunition. The key is communication. For Marines to engage targets effectively, they must communicate effectively with each other. Effective communication between Marines requires they know and use proper terminology. When Marines understand each other and their weapons, target engagement improves.

You can classify machinegun fire in relation to three factors: ground, gun, and target. Each class of fire is unique and has appropriate applications. Your ability to deploy your machinegun will improve greatly if you understand how these three factors influence your machinegun fire. Being able to communicate about these classes of fire will improve your ability to deploy your machinegun. Now let's define some terms.

a. Trajectory. The trajectory is the path of the bullet. The trajectory begins when the round is fired and it ends when the bullet strikes the target or another object. The trajectory of a bullet fired from the M240G machinegun, as with most other weapons, is curved and its curvature increases with the range (see fig 3-1).

b. Line of sight. The line of sight is the imaginary straight line that runs from your eye, through the sights of the weapon, down range to the target (see fig 3-1).

c. Ordinate. Ordinate is the distance between any point on the trajectory and the line of sight. When firing at maximum range with the M240G machinegun, the ordinate increases for about two-thirds of the distance to the target, then it decreases for the remaining third (see fig 3-1.)

d. Maximum ordinate. The maximum ordinate is the highest point along a bullet's trajectory. When you fire the M240G machinegun at its maximum effective range, the round reaches its maximum ordinate approximately two-thirds of the distance to the target (see fig 3-1).

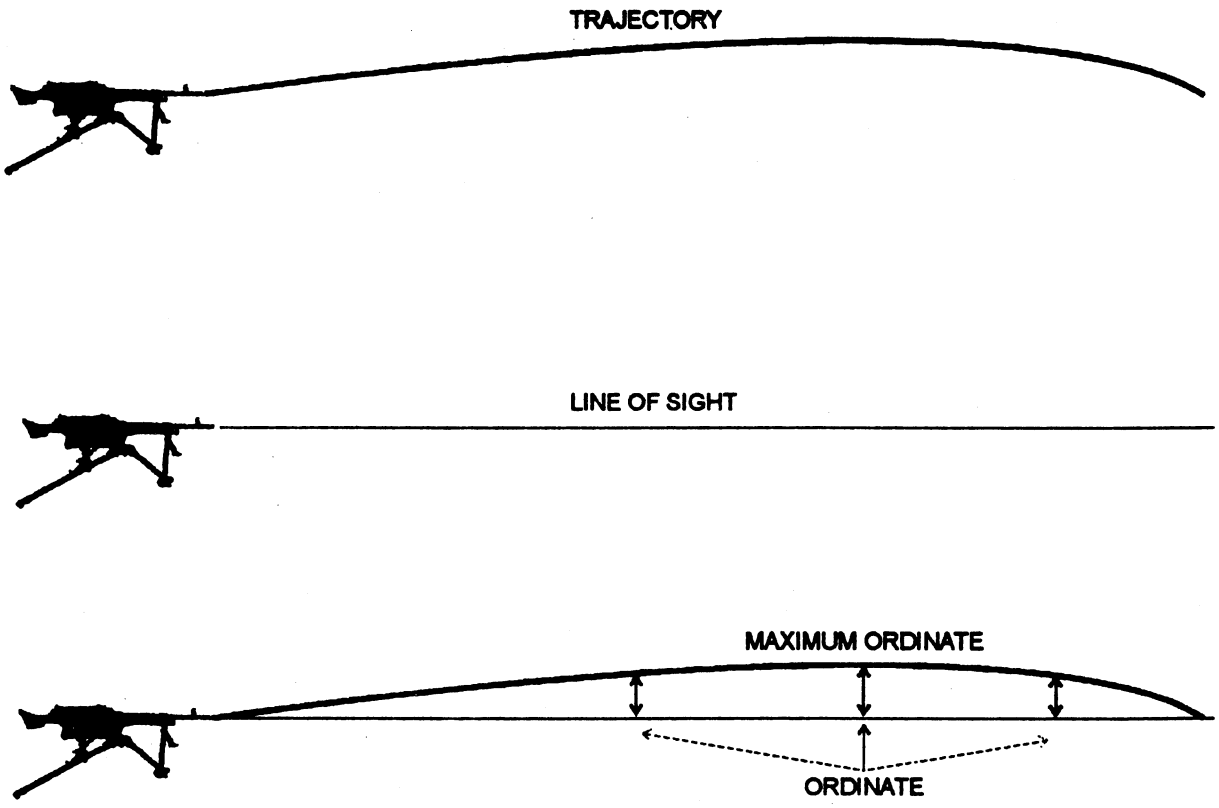


Fig. 3-1. Trajectory, line of sight, and maximum ordinate of a round.

e. Cone of fire. When you fire a burst, the bullets do not all follow the same path. Vibrations of the gun and mount, variations in ammunition, and atmospheric conditions combine to cause each trajectory to differ slightly from the others in that burst. The pattern formed by these trajectories is cone-shaped and is referred to as the "cone of fire" (see fig 3-2).

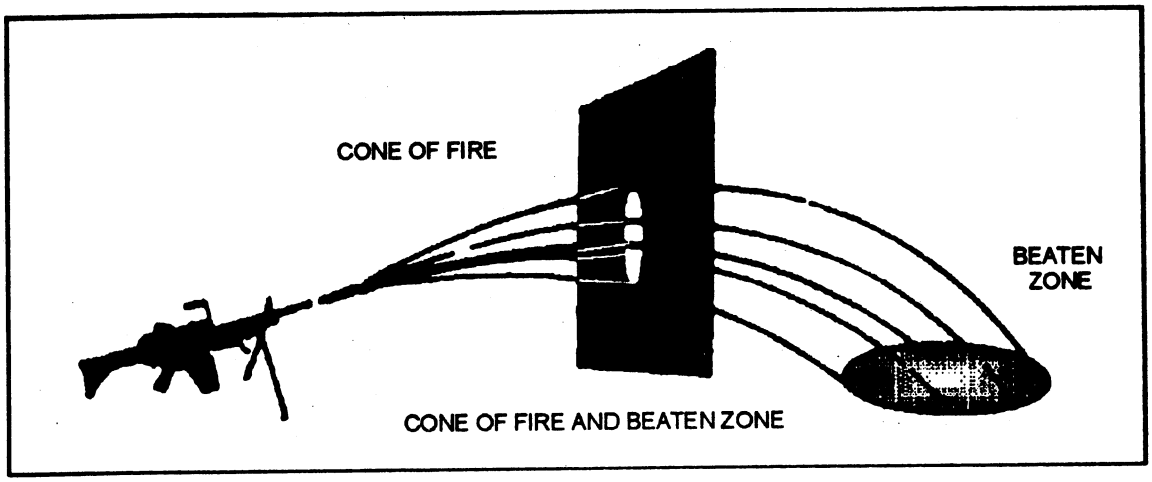


Fig 3-2. Cone of fire and beaten zone.

f. Beaten zone. As the bullets strike the ground, they form an elliptical pattern. This pattern is called the beaten zone. The center of the beaten zone is called the center of impact. It is not important for you to know the exact lengths and widths of beaten zones. However, you should know that as the range to the target increases, the beaten zone becomes shorter and wider. Additionally, you should know that the slope of the terrain will affect the length of the beaten zone, but will not affect its width. The average width of the beaten zone formed by a burst from your M240G machinegun is approximately 2 mils wide at all ranges. Since one mil is one meter wide at a distance of 1000 meters, you can easily calculate the width of the beaten zone by multiplying 2 mils by the range, expressed in thousandths of meters (see fig 3-3).

Note: See Appendix B, Table I, "Angles of Elevation, Dimension of Cone and Beaten Zone, Angles of Fall, Times of Flight, and Drift - How to Use."

(1) To compute the width of the beaten zone in meters at a range of 500 meters, multiply 2 (mils) times .5 (range in thousands of meters). The result is 1 (width of the beaten zone in meters).

(2) To compute the width of the beaten zone in meters at a range of 1000 meters, multiply 2 (mils) times 1 (range in thousands of meters). The result is 2 (width of the beaten zone in meters).

(3) To compute the width of the beaten zone in meters at a range of 1500 meters, multiply 2 (mils) times 1.5 (range in thousands of meters). The result is 3 (width of the beaten zone in meters).

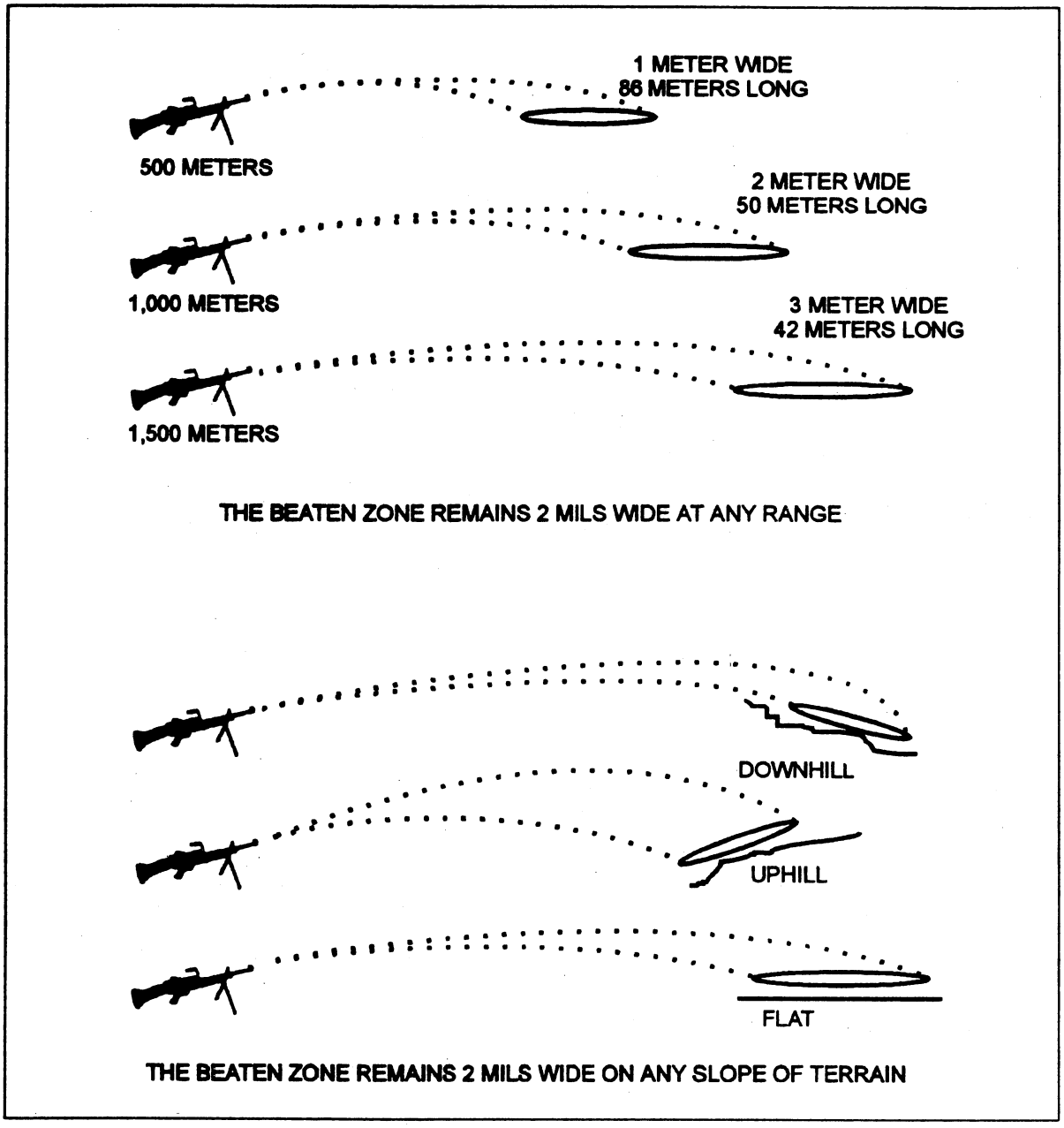


Fig 3-3. Beaten zones vary with range and terrain.

Now you know the six characteristics of fire and their definitions. Time to test yourself:

?	What is the trajectory? Did you answer "The path of the bullet"? Good! --- What is the maximum ordinate? Did you answer "The highest point along a bullet's trajectory"? Great!

3102. Classes of Fire in Relation to the Ground

a. Grazing fire. One class of fire is grazing fire. The center of the cone of fire does not rise more than one meter above the ground. The M240G machinegun will deliver grazing fire up to 600 meters over level or uniformly sloping terrain. An average-sized person standing anywhere along the gun target-line will be struck by grazing fire (see fig 3-4). In a good defensive position, your machinegun can deliver grazing fire across the majority of your unit's front, interlocking with the fires of adjacent machineguns.

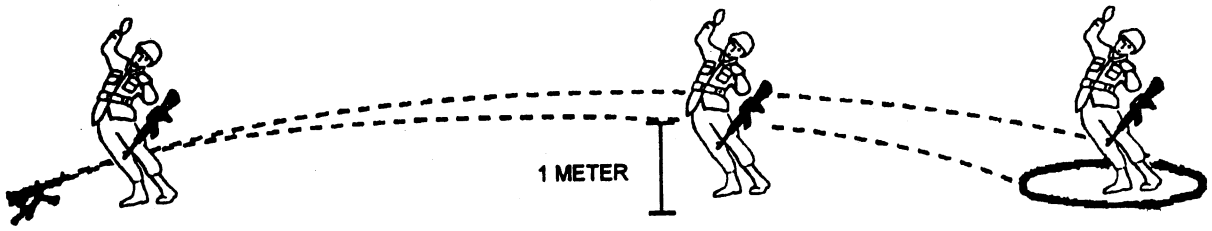


Fig 3-4. Grazing fire.

b. Plunging fire. The second class of fire is plunging fire. Plunging fire is obtained when, relative to the slope of the ground, the rounds fall at an angle that practically confines the danger zone (that area where a man cannot safely stand) to the beaten zone and, further, materially shortens the length of the beaten zone. Plunging fire can be obtained when firing from high ground to low ground, when firing from low ground to high ground, and when firing at long ranges. Figure 3-5 demonstrates all three of these situations. Plunging fire can be very effective because hostile personnel cannot avoid your fire by merely getting into small depressions and holes. To avoid plunging fire, hostile personnel must acquire overhead cover--an option not usually available for attacking units on contested ground.

Knowing these two classes of fire and their relation to the ground will help you make decisions about how to use your machinegun for maximum effectiveness.

?	In grazing fire, how far above the ground does the center of the cone of fire rise? Did you answer "A maximum of one meter"? Great! """ Can you define "plunging fire"? Did you say "It is the fire that practically confines the danger zone to the beaten zone"?

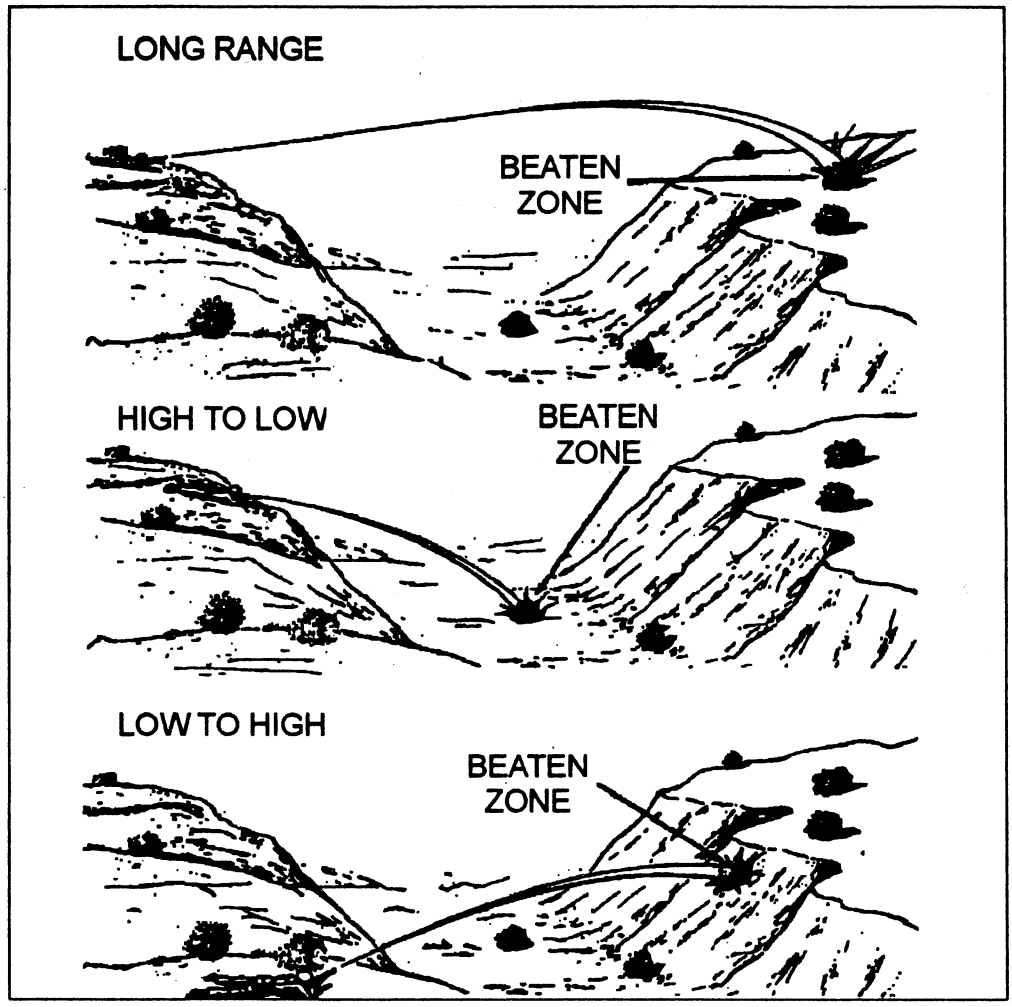


Fig 3-5. Plunging fire.

3103. Classes of Fire in Relation to the Gun

a. Classification. Fire is classified in relation to the gun and according to the manipulation you must perform to deliver effective fire.

b. Fixed fire is delivered when no manipulation of the gun is required. You may fire fixed fire using any mount, but it is normally fired from a tripod with the T&E locked in place. You generally will use it against stationary point targets.

c. Traversing fire is delivered against a wide target that requires successive changes in the direction of the gun when the beaten zone is not long enough to cover target. When engaging a wide target that requires traversing fire, the gunner should select successive aiming points throughout the target area. These aiming points should be close enough together to ensure adequate target coverage, but not so close that ammunition is wasted by the concentration of a heavy volume of fire in a small area.

d. Searching fire is delivered in depth by successive changes in the elevation of the gun. The amount of elevation change depends upon the range and slope of the ground. You will normally use searching fire against deep targets, such as when you are providing a base of fire and tasked with multiple targets.

e. Traversing and searching fire is delivered when both changes in direction and elevation are required. Employ it against a target whose long axis is oblique to the direction of the fire.

f. Swinging traverse fire is delivered against targets that require large and rapid changes in direction, but little or no change in elevation. Such targets may be dense, of considerable width, and in relatively close formations moving slowly toward or away from the gun. These targets include vehicles or mounted troops moving across your front. The traversing slidelock lever is loosened enough to permit the gunner to swing the gun laterally.

g. Free gun is delivered against moving targets that must be quickly engaged and that require rapid changes in both direction and elevation. Examples of targets include aerial targets, vehicles, mounted troops, or infantry in close formation moving rapidly toward or away from the gun position. Fire the free gun by removing the T&E.

Knowing the six classes of fire in relation to the gun will help you in make decisions about how to use the machinegun for maximum efficiency.

?	When would you use searching fire? Did you say "Against deep targets"? Great! When would you use fixed fire? Did you answer "Fixed fire is delivered when no manipulation of the gun is equired."? Excellent!

3104. Classes of Fire in Relation to the Target

a. Classes of fire. There are four classes of fire as they relate to the target. Their classification is based on two factors:

(1) The direction of enemy movement

(2) Coverage of the enemy's formation

b. Frontal fire is directed into the face of the enemy (see fig 3-6). The long axis of the beaten zone is at a right angle to the long axis of the target.

c. Flanking fire is delivered against the flank of a target (see fig 3-6).

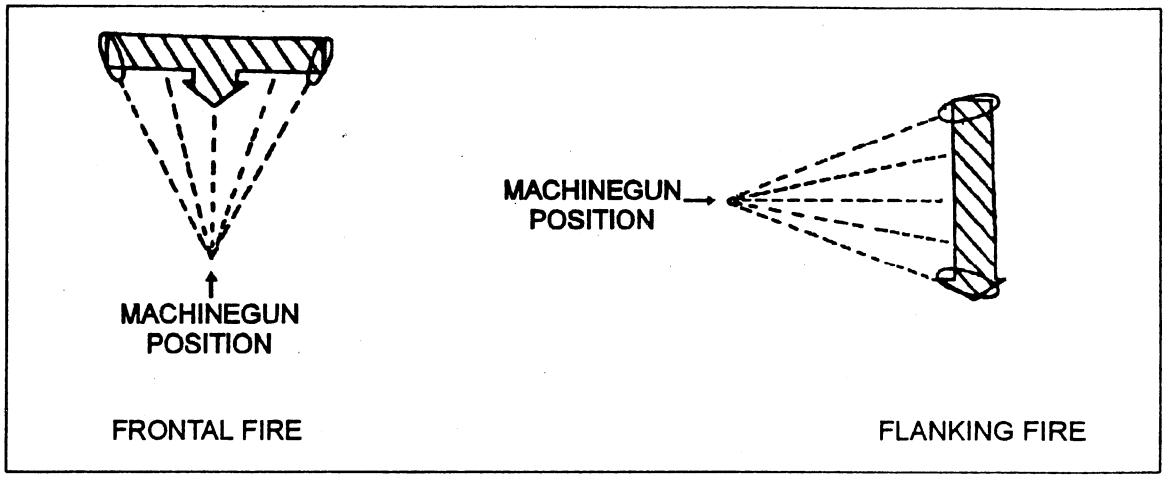


Fig 3-6. Frontal and flanking fire.

d. Oblique fire. The long axis of the beaten zone is at an angle, but not a right angle, to the long axis of the target (see fig 3-7).

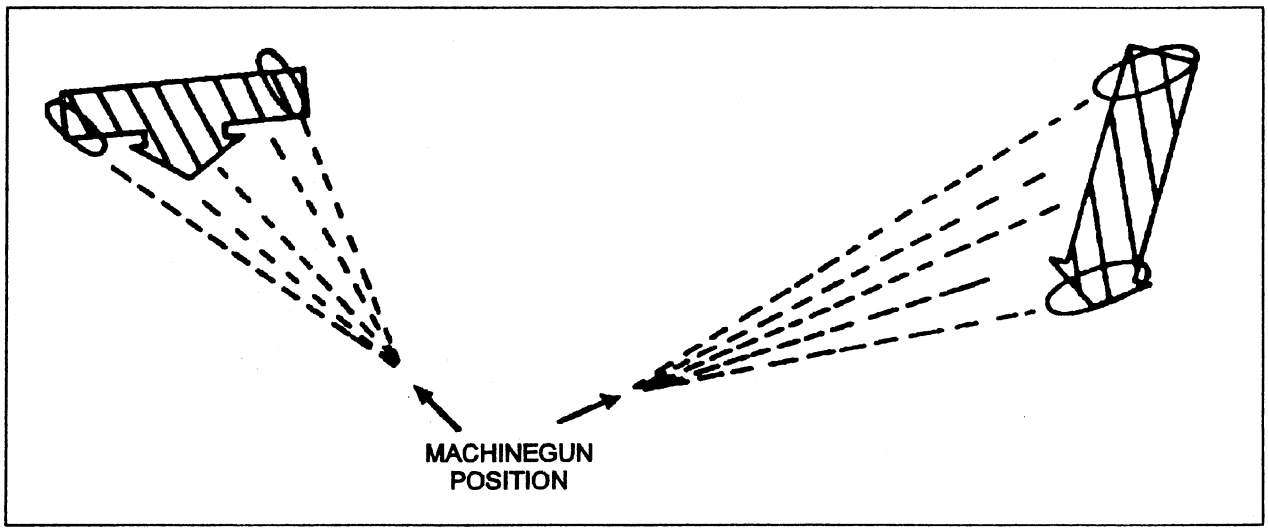


Fig 3-7. Oblique fire.

e. Enfilade fire is delivered in such a way that the long axis of the beaten zone coincides or nearly coincides with the long axis of the target. This class of fire is the most desirable class of fire with respect to the target because it maximizes the use of the beaten zone. As you will note in observing figure 3-8, enfilade fire can be combined with both frontal and flanking fire. During employment of your machinegun, you should attempt to anticipate the enemy's direction of

movement and his type of formation. You may be able to accurately predict how your enemywill present himself because of terrain and/or the type of formation in which he is moving. If this is the case, you should endeavor to place your machinegun in a position that will allow you to use enfilade fire, ensuring maximum effectiveness.

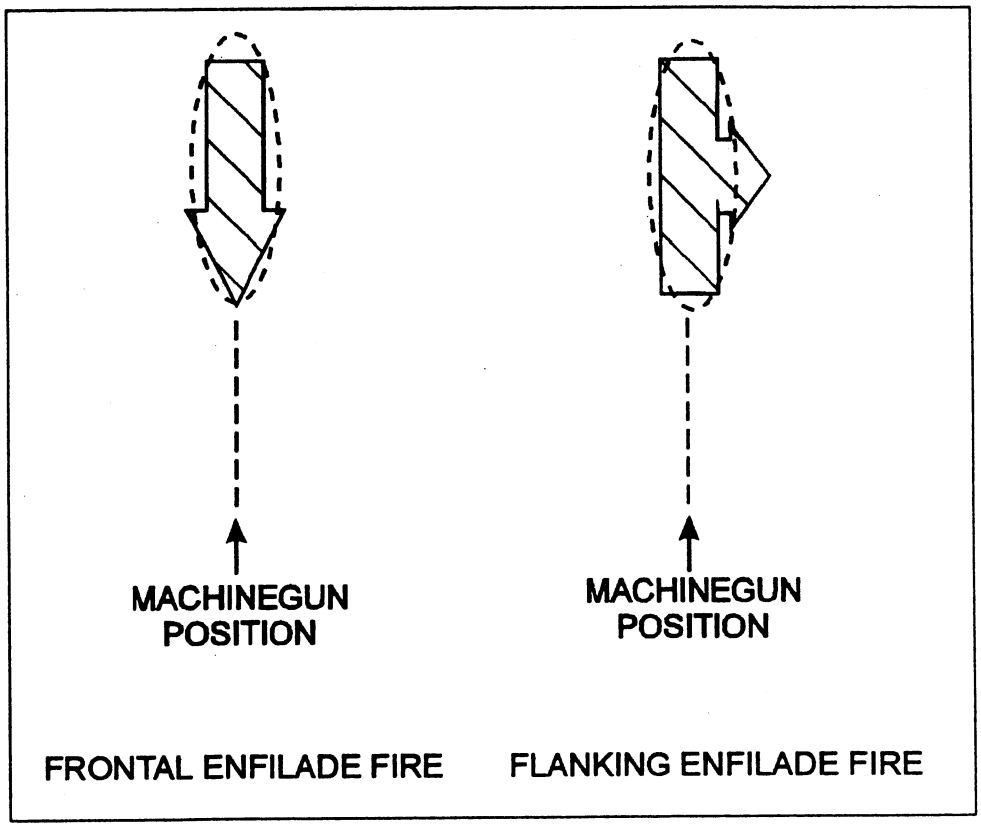


Fig 3-8. Enfilade fire.

Review! The four classes of fire in relation to the target are:

- Frontal
- Flanking
- Oblique
- Enfilade

?	Which two factors determine which class of fire is used to engage targets? ♦♦♦ Did you answer as follows? "The direction of enemy movement and the coverage of the enemy's formation." Great!

Table 3-1 shows all the classes of fire and their relationships.

Table 3-1. Classes of Fire and Their Relationships

CLASS OF FIRE	IN RELATION TO
Grazing	Ground
Plunging	
Fixed	Gun
Traversing	
Searching	
Traversing searching	
Swinging traverse	
Free gun	
Frontal	Target
Flanking	
Oblique	
Enfilade	

Lesson Summary. You have covered the classes of machinegun fire in relation to the ground, the machinegun, and the target. In the next lesson you will cover range estimation.

Lesson 2. ESTIMATING RANGE

LEARNING OBJECTIVES

1. Identify the sequence of steps used to estimate ranges using the 100-meter unit of measure method.

2. Select the key concept for using the appearance-of-objects method of range estimation.

3. Identify five alternate methods of range estimation and their characteristics.

4. Match the factors that can affect range estimations with their effects.

3201. General

One of the most important skills you can develop as a machinegunner is range estimation. By accurately determining range, you can get your initial burst on the target and maximize your impact on the enemy. An initial burst on target can cause great psychological shock and physical casualties, taking a large toll on the enemy before they can take cover and return fire. Like any other fire, machinegun fire has limited effect against hostile forces in covered positions. This is why the best time to hit the enemy is when they are not expecting it and are exposed. By accurately determining range through good range estimation skills, you can achieve an initial burst on target and cause the most damage to the enemy.

3202. 100-Meter Unit of Measure Method

a. The most frequently used method of estimating ranges is the 100-meter unit of measure method, which is based on your ability to estimate, by eye, the length of a 100-meter distance. If you played football sometime in your life, this should be easy since 100 meters is just a little longer than a football field. However, to be very proficient, this skill will require constant practice. The steps to develop and practice this skill are outlined below:

(1) Visualize a straight line on the ground between you and your target.

(2) Starting from your position, estimate how many 100-meter increments (or football fields) are between you and your target on this straight line (see fig 3-9).

(3) If a portion remains, estimate how large that portion is and add this to the number of 100-meter increments you have already visualized. This will give you a surprisingly accurate estimate of the range.

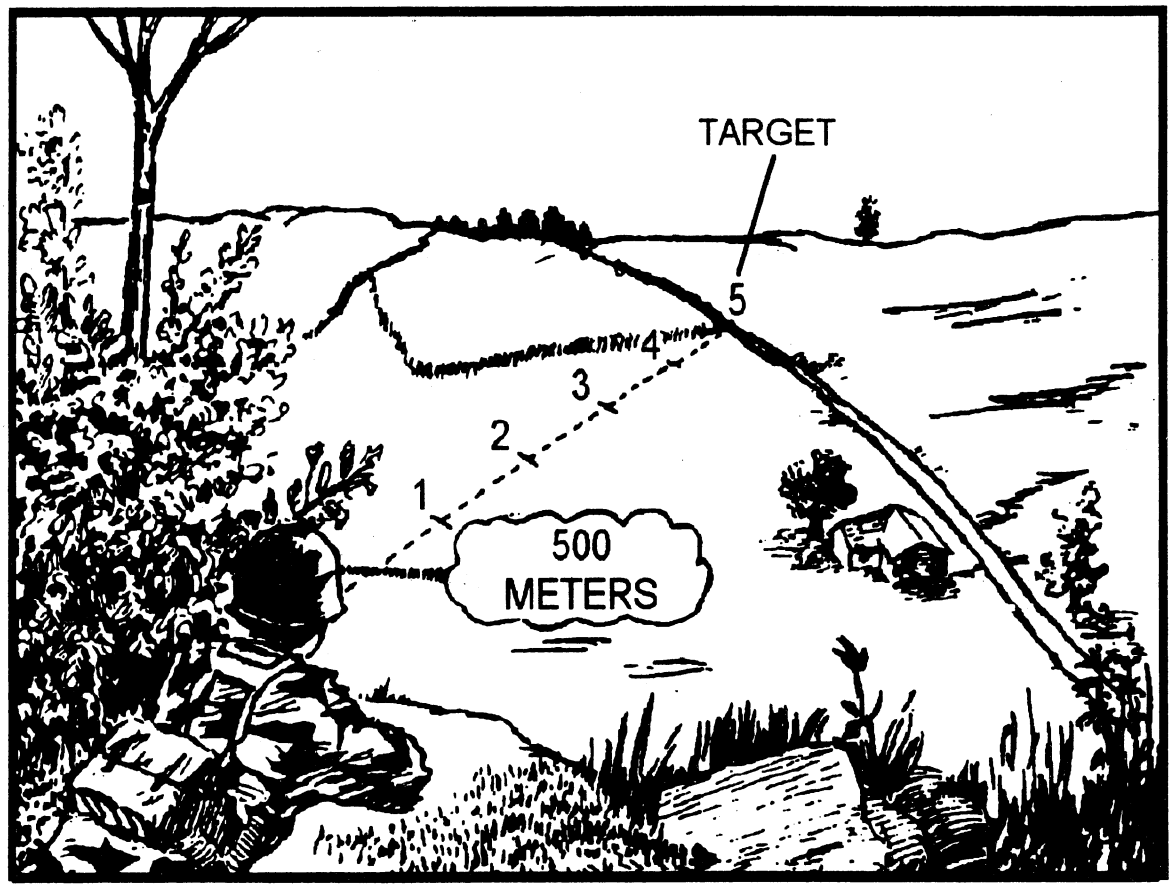


Fig 3-9. 100-meter unit of measure method.

Note: For ranges greater than 500 meters, it is often best to first estimate a midpoint on the imaginary line. Make an estimate for only that portion up to the midpoint. Then, double that distance (see fig 3-10).

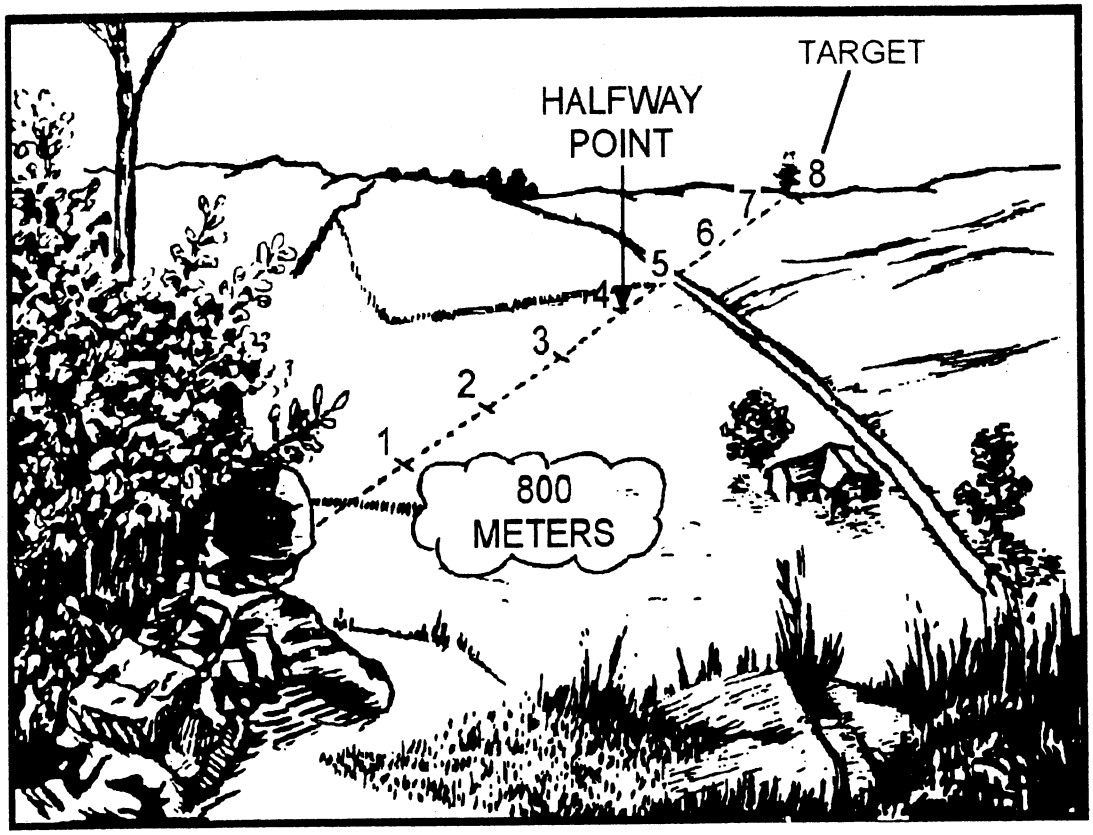


Fig 3-10. Greater than 500-meter unit of measure method.

3203. Appearance-of-objects Method

Another way to estimate ranges is by comparing the appearance of an object with your memory of how large that object looks at various ranges. For example, let's say you desire to estimate the range to an enemy soldier directly in front of you. Think back and compare his appearance to your memory of people at various ranges. By doing this, you will determine an estimate of the distance to the soldier.

The rifle range is good place to practice this skill and commit images at known distances to memory. While at the rifle range, get accustomed to observing the size of Marines at the various firing lines. Observe and compare sizes of objects, like trucks, tanks, and fence posts, at various known distances.

This method, like the 100-meter unit of measure method, requires constant practice. When outdoors with other Marines, practice estimating distances, then compare estimates. Once you have made an estimate, find out the actual distance whenever possible.

3204. Alternate Methods of Range Estimation

There are many different methods of estimating distances, but few are applicable to the battlefield. The following paragraphs discuss some of them and their particular application for Marines.

a. Firing the gun. To determine range by firing the gun, you first must have a zeroed gun. Fire at a terrain feature and manipulate the gun until your rounds strike where you want. Without disturbing the lay of the gun, manipulate the rear sight until you have a correct sight picture on the terrain feature. Then, note the range reading on the rear sight and record it as the range to the terrain feature.

This method has only one redeeming quality--it provides you very real and accurate information about range and T&E settings for your range card. However, it also has some serious drawbacks. First, it uses ammunition. But, more importantly, it gives away your location and your unit's defensive fire plan. This is dangerous. Therefore, use this method only when necessary and tactically feasible.

b. Maps or aerial photographs. You can determine ranges from maps or aerial photographs if you know the scale and the gun position. When a target appears near a known terrain feature, use the range to the terrain feature to estimate the range to the target by simply measuring the distance on the map.

This method also has some serious faults. The greatest fault is that usually the map or photo does not show enough detail to make very accurate estimates. Further, the distance that can be derived from a map or aerial photo will not account for vertical elevation changes that can seriously affect the accuracy of your estimate. Finally, to use this method, you must have maps or photos; these may not always be available to you.

c. Stepping off the distance. In a defensive situation with time permitting, you may determine range by stepping off the distance to a probable target. Simply walk to the probable target location and back, counting your paces in both directions. Hopefully, you know your pace count. If not, use the average of 64 paces (128 steps) = 100 meters.

Stepping off the distance is very accurate, but in wartime it is very limited. There are several disadvantages. First, it is very time consuming; second, it is very hazardous while you are out stepping; and, finally, as you are stepping, you expose both your unit's location and your unit's fire plan if the enemy observes you.

d. Obtaining data from other units. When moving into positions occupied by other units, their range cards (see study unit 4) provide a ready source of information on known and suspected targets. This method is relatively accurate and fast, requiring little more than the time to have a short discussion. However, it only applies at those times when your position has been previously occupied.

?

Which method of range estimation is used most frequently?

If you answered "The 100-meter unit of measure method," you are right! Good job.

What is the one redeeming quality of firing the gun to determine the distance?

Did you say "It provides real, accurate information about the range"? Good!

e. Using binoculars. Use your binoculars and the following formula to estimate the range:

FORMULA:

Distance = [the effective height of average person (in meters) ÷ by size read (in mils)] ×1000

Explanation: The effective height of the average person is 1.8 meters. So, if you look through your binoculars and read size 8 mils, your formula would be as follows:

1.8 (meters) ÷ 8 (mils) ×1000 = 225 meters

However, it is *easier* if you rearrange the equation. Multiply the effective size by 1000, then divide by size read, as shown below:

1.8 (meters) ×1000 = 1800 ÷8 (mils) = 225 meters

For a quick reference, look on your binoculars for the formula for calculating distance.

3205. Factors Affecting Range Estimates

Certain factors affect the accuracy of your range estimates. By understanding these factors and how they affect your estimates, you can easily compensate for them. Again, practice determines how good you become at estimating and compensating.

Unit leaders should test and train their Marines in these skills. Dedicated training time combined with practice of these skills would be time well spent.

Table 3-2 presents factors and their effect on range estimates.

Table 3-2. Factors and Their Effect on Range Estimates

FACTORS AND THEIR EFFECT ON RANGE ESTIMATES	
Factor	**Effect**
Ground slopes upward	Gives illusion of greater distance
Ground slopes downward	Gives illusion of shorter distance
Deep depressions	Objects appear closer
Straight section of road or railroad track	Objects appear closer
Flat surface on a clear, bright day	Objects appear closer
When silhouette is well defined	Objects appear closer
Looking through forests	Objects appear farther away
Looking down crooked, narrow streets	Objects appear farther away
When silhouette is partially covered or dim	Objects appear farther away
During poor visibility (fog, smoke, etc.)	Near objects appear closer; far objects appear farther away

A machinegunner must know the methods to estimate range and the effect of different factors on range estimation. As a machinegunner, you should practice range estimation constantly.

Lesson Summary. In this lesson you found out how to estimate range using the 100-meter method and the appearance-of-objects method. You also learned about five alternate methods of range estimation. In addition, you learned about the effects of various factors on range estimation. The next lesson covers fire commands.

Lesson 3. FIRE COMMANDS

LEARNING OBJECTIVES

1. Identify the elements of an initial fire command.
2. Select the correct method for requesting a fire command be repeated.
3. Select the correct method for correcting an erroneous fire command.
4. Identify the purpose of subsequent fire commands.

3301. Purpose of Fire Commands

Through fire commands, the unit leader controls the fires of his unit. In his fire commands the unit leader communicates a lot of information to you. Fire commands are his way of telling you:

- He wants you to fire
- Where the target is
- What the target is
- When to start firing
- How far away the target is
- How you should engage the target

3302. Initial Fire Commands

a. ADDRAC. Use the simple acronym ADDRAC to remember the elements of an initial fire command:

A Alert - Alerts the crews of a fire mission

D Direction - Use when the target is not obvious; direction given as **Front, Right (Left) Front, Right (Left) Flank, etc.**

D Description - Use only when target is not obvious; a quick description of one or two words

R Range - Given in meters to target

A Assignment/Method - Use only when specific assignments are required to divide the target, to assign class of fire, or to designate the rate of fire

C Control/Command - Indicates when to fire and the rate of fire

b. Types of fire commands. The type of fire command issued and the way the information is passed to the members of the squad/unit depend on the situation.

(1) Repetition. Usually, only the squad leader issues fire commands because machineguns are normally deployed by squads. The fire command is then repeated by all members in the squad. Repeating the command ensures each Marine in the squad understands the command. When a machinegun section deploys as a unit, many more Marines are involved. Fire commands issued by the section leader cannot be heard by all members of the section because of the distance between squads. Therefore, it is necessary for the squad leaders and all members of the unit to repeat the command.

(2) Other. However, repetition of the command by all members does not work in all situations. For example:

(a) If surprise is an important factor to the success of the mission

(b) If the noise level of battle is too great for commands to be heard. In such cases, the squad leader will issue commands individually, by hand and arm signals if necessary, or the individual Marine must react and function independently according to the battle drills, unit SOPs, the mission, and the commander's intent.

c. Elements of a fire command. In this section, the initial fire command is broken down into its elements and explained. Examples of the elements are provided.

(1) Alert. This first element of the initial fire command serves two functions:

(a) Alerts you that a fire command is forthcoming

(b) Designates which gun teams will fire the mission.

Examples:

"FIRE MISSION"	Both guns are to engage target on command.
"GUN ONE, FIRE MISSION"	Only gun #1 will engage the target, but gun #2 will standby at the alert and observe the mission.

(2) Direction. If the target is not obvious, this element directs your attention to a particular direction or target. This element may be skipped if the target is singular and obvious.

Examples:

"LEFT FRONT"	Target is to the front and slightly left of your position.
"RIGHT FLANK"	Target is to the right flank of your position.

An alternate method of indicating the location of targets is to use a reference point. In place of or in conjunction with "direction," a reference point can be used to indicate the location of partially or wholly obscured targets.

Examples:

"REFERENCE, LONE TREE"	Target is located in the area of the lone tree.

"REFERENCE, LONE TREE, DIRECT FRONT, RIGHT FIVE ZERO"	Target is located in the area of the lone tree, directly in front of your position, approximately 50 meters to the right.

A target can also be designated by firing a burst of tracers or a smoke round at the target.

Examples:

"REFERENCE, WATCH MY BURST"	Target will be marked by a burst of rifle fire.
"REFERENCE, YELLOW SMOKE"	Target will be marked by yellow smoke.

(3) Description. Your squad leader will describe the target in short, accurate words or phrases. If a reference point is used, your squad leader may combine the reference and description in one statement. This element of the fire command can describe any type of enemy target.

Examples:

"TROOPS IN THE OPEN"	Target is dismounted troops in the open.
"REFERENCE, LONE TREE, DIRECT FRONT BUSH WITH TROOPS BEHIND"	Target is in the area of the lone tree located directly in front of your position. There are troops hiding behind a bush (the bushes).
"SECOND TRUCK FROM FRONT"	Target is the second truck back from the front of a column.

(4) Range. In this element of the fire command, your squad leader helps you locate the target and establish the correct sight setting before you engage the target. The squad leader will announce his estimate of the range in increments of one hundred meters.

Examples:

"ONE HUNDRED"	Target is located one hundred meters out. You should set your sight on the 200-meter setting, which is the lowest setting.
"NINE HUNDRED"	Target is located nine hundred meters out. You should set your sight on the 900-meter setting.

There is no need for the squad leader to announce "ranges" or increments smaller than one hundred meters. The range element will always be part of the initial fire command.

(5) Assignment/Method. Your squad leader will use this element only in the following circumstances: if he feels there is a need to assign different sectors of fire within a single target, to indicate a method of engagement, and/or to direct a the rate of fire to be used. In many cases, he will not use this element because common sense and the previous elements will have provided you with enough information.

Examples:

"NUMBER ONE, LEFT HALF; NUMBER TWO, RIGHT HALF; TRAVERSE; AT THE RAPID RATE"	The number one gun will fire only on the left half of the target and the number two gun will fire only on the right half of the target. Both guns will use a traversing manipulation and fire at the rapid rate of fire.
"NUMBER ONE, TOP TWO-THIRDS; NUMBER TWO, BOTTOM TWO-THIRDS; SEARCH AT THE SUSTAINED RATE"	The number one gun will fire only on the top two-thirds of a deep target while gun number two engages the bottom two-thirds of the target. Both guns will be firing at the sustained rate of fire.

(6) Control/Command. Your squad leader will use this element to tell you when to start placing highly lethal fire on the enemy.

Examples:

"FIRE"	Your squad leader wants you to start firing immediately. You will rapidly lay on the target; start firing as soon as you are ready.
"COMMENCE ON MY BURST"	Your squad leader wants you to start firing immediately after the squad leader starts to fire. You will lay on the target and inform your squad leader when you are ready by announcing "GUN NUMBER ONE UP."
"AT MY COMMAND"	Your squad leader wants you to fire when he announces "FIRE." You lay on the target and announce "GUN NUMBER TWO UP" when you are ready.

Your squad leader should avoid using the word **"FIRE"** in any element of a fire command except the alert and the control/command elements, and then only if he wants you to start firing that instant. Any other usage of the word **"FIRE"** can result in rounds being fired unintentionally.

Fire commands should be as brief and concise as possible. Any information that is obvious should be omitted. At a minimum, fire commands must contain at least some form of each of the following three elements:

- Alert
- Range
- Control/Command

?	Do you remember what the acronym ADDRAC stands for? Your answer should be "**A**lert, **D**irection, **D**escription, **R**ange, **A**ssignment, and **C**ontrol." Excellent!

3303. Requesting Repeat of Fire Commands

There are times when you will want to have the initial fire command repeated. Often the volume of noise on the battlefield will make it difficult to hear initial fire commands. Or, due to the nature of the tactical situation, the squad leader may be required to whisper the command to you so it will not be heard. In such situations, you will request that the squad leader repeat the command and he will respond as follows.

Example 1:

Gunner:	**"SAY AGAIN MISSION"** or **"MISSION?"**
Squad leader:	**"THE MISSION WAS LEFT FLANK, TROOPS DUG IN, FIVE HUNDRED, FIRE!"**

Example 2:

Gunner:	**"SAY AGAIN RANGE"** or **"RANGE?"**
Squad leader:	**"THE RANGE WAS FIVE HUNDRED"**

To avoid confusion, the squad member who requests the repeat of a fire command does not use the words "REPEAT" or "FIRE." For example, when asking for a repeated command, the squad member says: **"SAY AGAIN RANGE."** Likewise, the squad leader does not use "REPEAT" or "FIRE." Rather, he responds with the element's title followed by the auxillary verb "was." For example, the squad leader repeats a command by saying: **"THE RANGE WAS . . . "**

3304. Correcting Fire Commands

Sometimes a squad leader makes a mistake when giving a fire command. If your squad leader should make such a mistake, he will correct himself. To avoid confusion, the squad leader will correct himself in a particular way. He will stop giving you the fire command as soon as he realizes he has made a mistake. Then, he will correct his error as demonstrated in the following examples. He makes the correction before continuing the fire command.

Example 1

The squad leader makes the initial fire command:	**"FIRE MISSION, DIRECT FRONT TROOPS IN THE OPEN, 500, AT MY COMMAND."**
The squad leader now modifies the original fire command to reflect the correct range of 700 meters.	**"CORRECTION, 700, FIRE."**

Example 2

The initial fire command began like this:	**"FIRE MISSION, LEFT FLANK, BESIDE THE BUILDING, TROOPS, 600, . . . (pause)"**
A correction. The squad leader realizes his original description of the target could mislead the gunners, causing them to engage the wrong target.	**"CORRECTION, LEFT SIDE OF THE RED BUILDING, AT MY COMMAND"**

3305. Subsequent Fire Commands

Subsequent commands are issued after the initial command has been executed.

a. If your squad leader wants to stop you from firing, but he does not want you to stand down from the alert status, his command will be **"CEASE FIRE."**

Note: At anytime, anyone can command cease fire in the event of an observed safety problem.

b. If your squad leader wants you to cease fire and stand down from the alert status, he commands: **"CEASE FIRE, END OF MISSION"** or **"CEASE FIRE, MISSION COMPLETE."**

c. If your squad leader wants you to adjust or shift your fire either to a different part of the current target or to a new target, he will give you an adjustment of fire. When adjusting fire, the deflection correction must always be given first.

Example 1

The squad leader wants you to shift your fire 50 meters to the right.	**"GUN ONE, SHIFT RIGHT FIVE ZERO"**

Example 2

The squad leader now wants gun number one to engage a new target, and he wants gun number two to engage all of the original target that both guns had been engaging.	**"GUN ONE, NEW TARGET, TROOPS IN THE TREE LINE, SHIFT LEFT TWO HUNDRED. GUN TWO, TRAVERSE ALL OF THE TARGET."**

If you combine these commands with your ability to estimate range, you will have the tools needed to engage targets when the distance is unknown.

Do you recall what the second "D" in ADDRAC stands for?

You are right if you said "description."

How do you request the range be repeated?

You did well if you said, "Say again range" or "Range."

Lesson Summary. This lesson covered the elements in the intial fire command, how to request that a fire command be repeated, the correct method for correcting an erroneous fire command, and the purpose of subsequent fire commands. The study unit review is next. Good luck!

Study Unit 3 Exercise: Complete items 1 through 33 by performing the action required. Check your responses against those listed at the end of this study unit.

Matching: For items 1-6, match each term in column 1 with its definition in column 2.

Column 1 Term of Machinegun Fire	Column 2 Definition
___ 1. Trajectory	a. The distance between any point on the trajectory and the line of sight
___ 2. Line of sight	b. The highest point along a bullet's trajectory above the line of sight
___ 3. Ordinate	c. The curved path of the bullet as it flies down range
___ 4. Maximum ordinate	d. The imaginary straight line running between your eye and the target
___ 5. Cone of fire	e. An elliptical pattern formed as your cone of fire strikes the ground
___ 6. Beaten zone	f. The cone-shaped pattern formed by the paths of the rounds
	g. The bullet does not rise above two feet

7. Identify the classes of fire with respect to the ground by selecting the two correct definitions.

a. Grazing fire is defined as fire parallel to the ground where the center of the cone of fire does not fall below two meters from the ground.

Plunging fire occurs when firing from high ground to low ground, or when firing at long ranges; it is fire in which the danger space is practically confined to the beaten zone.

b. Grazing fire is defined as fire where the center of the cone of fire does not rise above one meter from the ground.

Plunging fire occurs when firing from high ground to low ground, when firing into abruptly rising ground, or when firing at long ranges; it is fire in which the danger space is practically confined to the beaten zone.

c. Grazing fire is defined as fire where the center of the cone of fire does not rise above three meters from the ground.

Plunging fire is only fired from low ground into rising ground at short ranges; it is fire in which the danger space is totally confined to the beaten zone.

d. Grazing fire is defined as fire bounced off the ground where the center of the cone of fire, both before initial impact and after, does not rise above one meter from the ground.

Plunging fire occurs when firing from high ground to low ground, when firing into abruptly rising ground, or when firing at long ranges; it is fire in which the danger space is confined to the beaten zone.

Matching: For items 8 through 13, match each class of fire in relation to the gun in column 1 with its definition in column 2.

Column 1 Classes of fire		Column 2 Definition	
___	8. Fixed	a.	Fire used when the beaten zone is not long enough to cover the target
___	9. Traversing	b.	Fire used against targets needing large changes in direction and elevation
___	10. Searching	c.	Fire used against targets requiring large and rapid changes in direction
___	11. Traversing and searching	d.	Fire used on large area targets when the long axis of the target is in the oblique
___	12. Swinging traverse	e.	Fire delivered when no manipulation of the gun is required
___	13. Free gun	f.	Fire used when the beaten zone is not wide enough to cover the target

Matching: For items 14 through 17, match each class of fire in relation to the target in column 1 with its definition in column 2.

Column 1 Classes of fire		Column 2 Definition	
___	14. Oblique	a.	Fire directed into the face of the enemy
___	15. Flanking	b.	Fire delivered against the flank of a target
___	16. Frontal	c.	When the long axis of the beaten zone is at an angle, but not a right angle, to the long axis of the target.
___	17. Enfilade	d.	The class of fire most desirable with respect to the target
		e.	When you are firing overhead

18. Identify the correct sequence of steps used to estimate ranges using the 100-meter unit of measure method.

1. Estimate how large the remaining portion is and add this to the number of 100-meter increments you have visualized.
2. Estimate how many 100-meter increments are between you and your target.
3. Visualize a straight line on the ground between you and your target.

a. 3, 2, 1
b. 1, 2, 3
c. 2, 1, 3
d. 3, 1, 2

19. Select the key concept for using the appearance-of-objects method of range estimation.

a. To remember how large a man or piece of equipment looks at various ranges.
b. Never be without your M269 digital range finder and the interpretation tables for it
c. To remember how dark a man or piece of equipment looks at various ranges at various light levels
d. To remember how fast a man or piece of equipment appears to be moving at various ranges

20. Identify the five alternate methods of range estimation by selecting the correct list.

a. Firing smoke and observing drift
Map and aerial photograph studies
Stepping off the distance
Obtaining data from the T&E mechanism
Using binoculars

b. Firing the gun
Map and aerial photograph studies
Stepping off the distance
Obtaining data from other units
Using binoculars

c. Having mortar fire-marking rounds
Map and aerial photograph studies
Measuring the distance with survey equipment
Obtaining data from other units
Using binoculars

d. Firing the gun
Observing vehicle speeds and distances driven
Using the T&E mechanism
Obtaining data from stars and by using tables
Using binoculars

Matching: For items 21 through 29, match each factor that can affect range estimation in column 1 with its effect on range estimation accuracy in column 2.

Column 1		Column 2	
Factor		Effect	
___	21. Deep depressions	a.	Objects appear farther
___	22. Looking through forest	b.	Objects appear closer
___	23. Ground that slopes upward	c.	Far objects appear farther away; near objects appear closer
___	24. Straight section of road		
___	25. Ground that slopes downward		
___	26. Flat surfaces on a clear day		
___	27. When silhouettes are well defined		
___	28. When silhouette is partially covered or dim		
___	29. During poor visibility		

30. Identify the list that contains the correct elements of an initial fire command.

a. Alert
Deflection
Direction
Range
Assignment/Means
Control/Command

b. Abort
Deflection
Description
Range
Assignment/Mode
Control

c. Alert
Direction
Descripton
Range
Assignment/Method
Control/Command

d. Announcement
Direction
Description
Route
Aiming point
Command

31. Select the correct method for requesting a fire command be repeated.

a. "What was the range?"
b. "Repeat the range again."
c. "Range?"
d. "Say again, all after description."

32. Select the correct method for correcting an error given on a fire command.

a. "Correction, second vehicle in column."
b. "Change to command, second vehicle in column."
c. "Hold fire, correct to second vehicle in column."
d. "Correcting, make that second vehicle."

33. What are the purposes of subsequent fire commands?

a. To stop firing
To speed up firing
To adjust fire

b. To change rate of fire
To start new mission
To change assignments

c. To change barrels
To conserve ammo
To cease fire

d. To adjust fire
To cease fire
To end mission

UNIT SUMMARY

This study unit provided you basic knowledge about the M240G's employment, including putting rounds on target, giving commands to your machinegun team, and how to engage targets at an unknown distance. Next, study unit 4 covers engagement of various types of targets as well as firing in support of friendly troops.

Study Unit 3 Exercise Solutions

		Reference
1.	c.	3101
2.	d.	3101
3.	a.	3101
4.	b.	3101
5.	f.	3101
6.	e.	3101
7.	b.	3102
8.	e.	3103
9.	f.	3103
10.	a.	3103
11.	d.	3103
12.	c.	3103
13.	b.	3103
14.	c.	3104
15.	b.	3104
16.	a.	3104
17.	d.	3104
18.	a.	3202
19.	a.	3203
20.	b.	3204
21.	b.	3205
22.	a.	3205
23.	a.	3205
24.	b.	3205
25.	b.	3205
26.	b.	3205
27.	b.	3205
28.	a.	3205
29.	c.	3205
30.	c.	3302
31.	c.	3303
32.	a.	3304
33.	d.	3305

STUDY UNIT 4

ENGAGING TARGETS

Introduction. Your effectiveness as a machinegunner is based on your ability to destroy the enemy's fire power. You can accomplish this in several ways. You can kill the enemy himself, you can destroy his equipment, you can impede his ability to function as a member of his unit, or you can achieve a combination of these. However, you must keep in mind that you do not have an unlimited ammunition supply or all day to accomplish the mission. To support the riflemen in your unit effectively, you must engage targets as efficiently as possible.

Lesson 1. ENGAGING PERSONNEL OR STATIONARY TARGETS

LEARNING OBJECTIVES

1. Identify the fire used to engage wide targets.
2. Identify the fire used to engage deep targets.
3. Identify the fire used to engage oblique targets.
4. Identify the fire used to engage widely dispersed targets.

4101. Wide Targets

a. If your squad leader assigns a wide target for your gun alone, and the target has a width greater than two mils but smaller than one hundred mils, you can engage it using traversing fire by following the steps listed below:

(1) Select the correct range sight setting based on the fire command received from your squad leader. Then set the rear sight accordingly.

(2) While keeping your traversing handwheel centered, adjust the initial impacts onto the center of the target. Do this by sliding the traversing bar and manipulating the elevation handwheel; do not use the traversing handwheel. The reason you originally adjust onto the center of the target and not onto one of its flanks is to ensure that you have enough traverse adjustment on the traversing handwheel to cover the entire target.

(3) Once impacts are recorded at the approximate center of the target, traverse to one flank. Commence complete coverage of the target by firing and adjusting.

(4) After firing each six-round burst, you will immediately traverse 2 mils by turning the traversing handwheel two clicks. To traverse the muzzle (and impacts) left, you will turn the handwheel to the left, or away from you. As you would expect, to traverse right you will turn the handwheel to the right, or towards you. Traversing fire is demonstrated in figure 4-1.

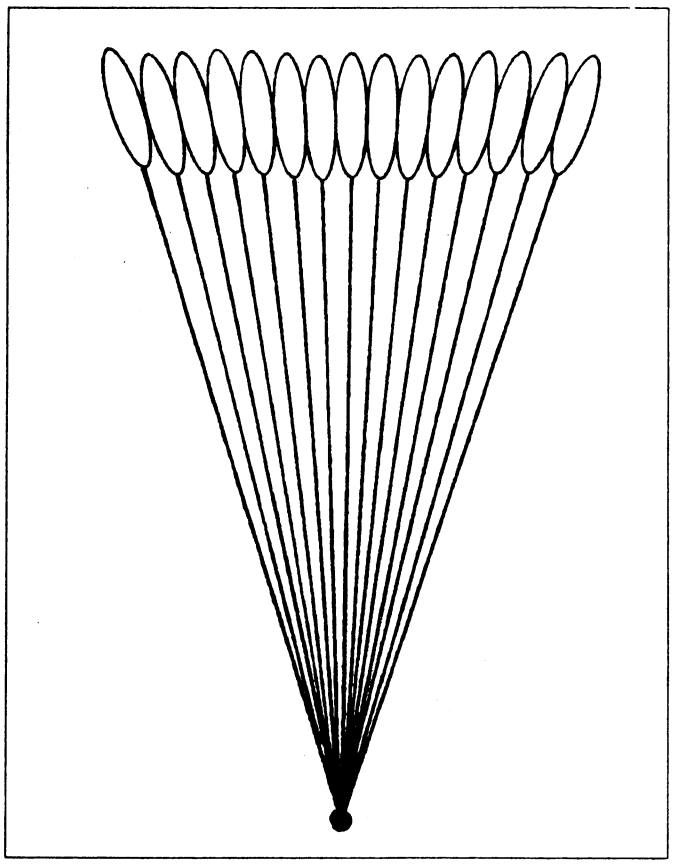


Fig 4-1. Single gun engaging a wide target.

b. If you deploy as a two-gun team squad (the most desirable method), your squad leader has several options. He may assign a wide target to just one gun (described above) or he may assign sectors of the target to both guns. The squad leader's assignments are based on the density and width of the target. He must keep in mind that each gun can only cover targets 100 mils wide or less without having to release the traversing slide and go to the swinging traverse. If the target is more dense at one end or in the center, the squad leader can assign each gun team unequal portions of the target (demonstrated in fig 4-2). Each gun will fire its initial bursts 2 mils outside its respective flank, covering its assigned portion.

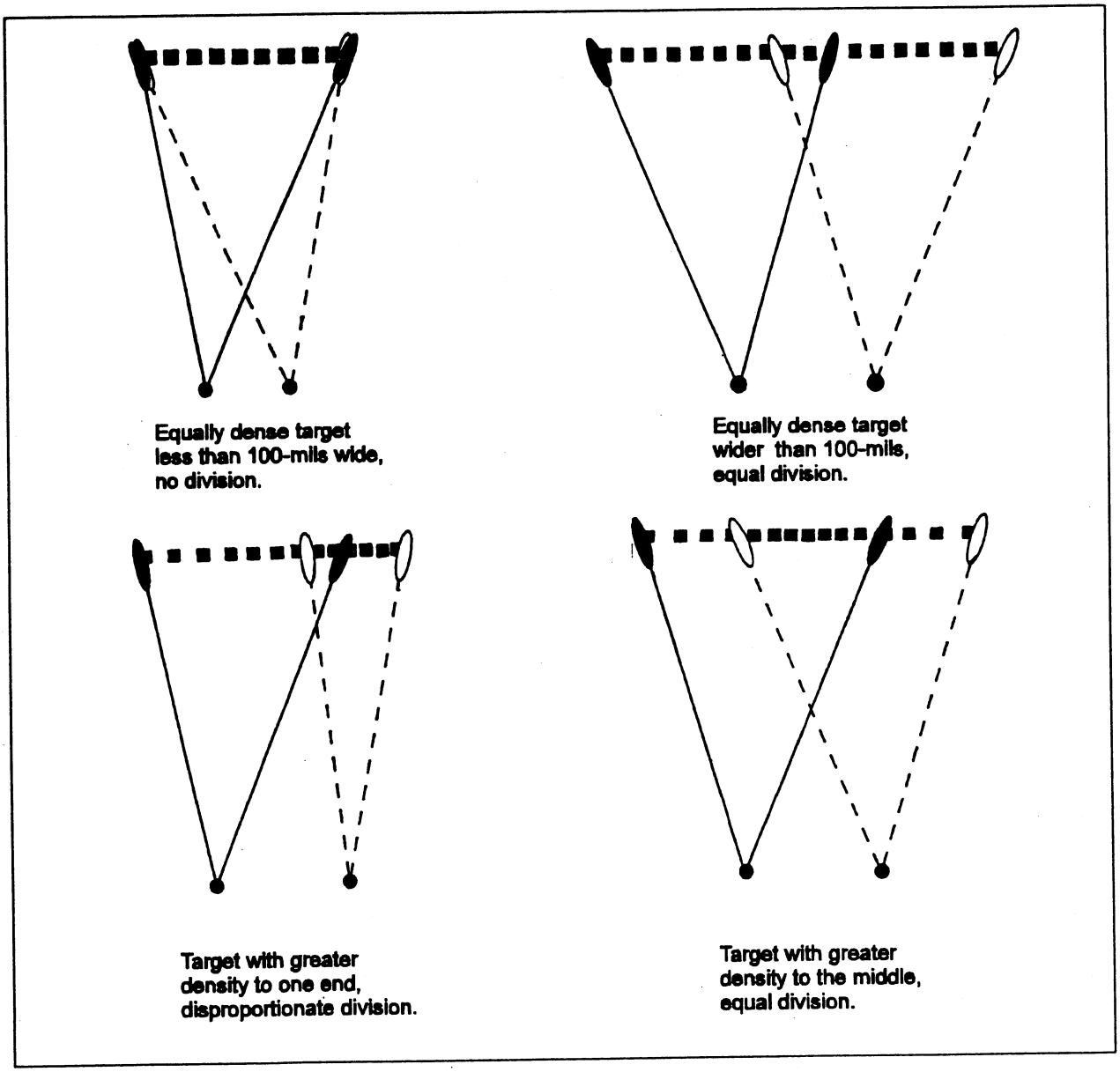


Fig 4-2. Two gun target distribution.

4102. Deep Targets

a. If your squad leader assigns a deep target for your gun alone, and the target has a depth greater than 2 mils and is completely within range, you can engage it using searching fire by following the steps listed below:

(1) Set your sight to the range announced in the initial fire command.

(2) While keeping your traversing handwheel centered, adjust your initial impacts onto the near limit of the target by sliding the traversing slide left or right along the

traversing bar and manipulating the elevation handwheel; do not use the traversing handwheel. The reason you originally adjust onto the near limit of the target, and not the far end or the center, is to ensure that you get effective fire on the most threatening portion of the target first.

(3) Once your rounds are impacting at the near limit of the target, search to the far end. Completely cover the target by firing and adjusting.

(4) After firing each six-round burst, immediately search 2 mils by turning the elevating handwheel two clicks. To search up, push right up to turn the handwheel to the left. To search down, pull left down to turn the handwheel to the right.

b. If you are deployed as a squad, your squad leader has several options. He may assign a deep target just to your gun (described above) or he may assign sectors of the target to each of the two guns. As with wide targets, his assignments are based on the density and depth of the target. The squad leader must keep in mind that the length of the beaten zone varies depending on the slope of the terrain and the range. Additionally, he must consider the possibility of existing dead space. If the target is more dense at one end or in the center, the squad leader can assign your gun team and your fellow gun team unequal portions of the target (demonstrated in fig 4-3).

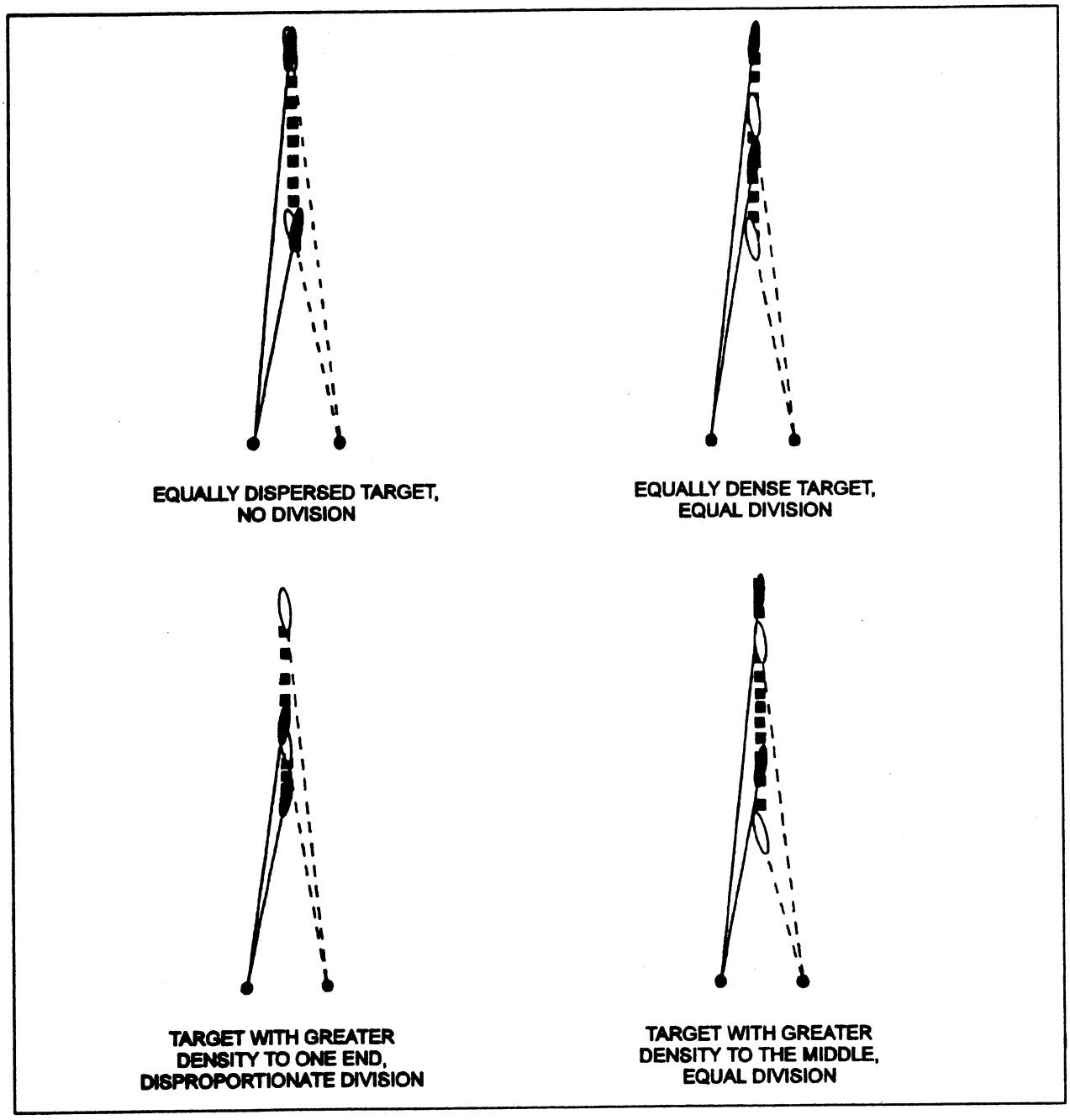


Fig 4-3. Target distribution.

c. A situation may exist in which the ground within your squad's sector of fire either extends far enough or rises high enough to make it impossible for one T&E mechanism to manipulate the entire span of elevation. In situations like these, your squad leader should direct the emplacement of one gun to allow that gun to fire on targets from the maximum elevation downward. The other gun would then be placed to fire from the minimum elevation upward. With your squad leader deploying you in this manner, both guns can engage a portion of the target and still be able to go to free gun and fire the entire depth of the sector.

4103. Oblique Targets

a. If your squad leader assigns a target for your gun that has its long axis running at an angle to your direction of fire, you can engage it using searching traverse fire by following the steps listed below.

(1) Set your sight to the range announced in the initial fire command.

(2) While keeping your traversing handwheel centered, adjust your initial impacts to the approximate center of the target by sliding the traversing slide left or right along the traversing bar and manipulating the elevation handwheel; do not use the traversing handwheel. The reason you originally adjust onto the center of the target and not onto either end is to ensure you have enough traverse to reach both extremes once firing and manipulation starts.

(3) Once your rounds are impacting at the center of the target, traverse to the near end of the target. Completely cover the target by firing and adjusting.

(4) After firing each six-round burst, immediately search 1 or more mils and traverse 2 mils. Adjust the angle both up and down the target by adjusting the number of clicks in the elevation rather than the traverse. The reason you adjust the angle with the elevation only is to ensure you completely cover the target.

b. If you are deployed as a squad, your squad leader again has similar options to those he had with both deep and wide targets. His assignments are based on the density and depth of the target. He must keep in mind that the length of the beaten zone varies depending on the slope of the terrain and the range. Additionally, he must consider the possibility of dead space.

c. A situation may occur in which your squad's sector of fire is greater in size than can be covered by the manipulations of one T&E mechanism. In these situations, your squad leader should direct the emplacement of one gun to fire on targets from one extreme inward towards the center of your sector. Another gun should be deployed to fire from the opposite extreme inward. When your squad leader deploys his squad members and guns in this manner, both guns can engage a portion of the sector yet still be able to go to free gun and fire the entire width and depth of the sector.

4104. Dispersed Targets

If your squad leader assigns a widely dispersed target for your gun, you can engage it in one of three ways. Your options are listed below:

- Treat each individual target as a point target
- Use the swinging traverse and rapid elevation changes
- Remove the T&E mechanism and go to free gun.

None of these methods should be considered universal for all occasions. As you decide which method to use, ask yourself some questions like the following:

"Do I have enough traverse and elevation on the T&E mechanism?"
"Can I get from one target to the next quickly enough?"
"How do I avoid firing on the same target as the other gun?"
"How can I ensure that I fire only in my assigned sector?"
"Do I have enough ammo to support this type of fire mission?"
"At the range required, can I hit a point target without the T&E mechanism?"

Your squad leader's fire command may answer some of these questions. He may direct the type of fire he wishes you to use. He may divide the sector into portions. And, he may not have both guns fire in an effort to conserve ammo and security.

You and your team leader must function as a team. Often, the only way you can get on target is by direction from someone with a better field of view than yous.

Table 4-1 provides a simple comparison of different target engagements:

Table 4-1. Comparison of Target Engagements

Target	Aim	Fire
Wide	Center	Traversing
Deep	Near limit	Search
Oblique	Center	Searching traverse
Dispursed	Combination	Combination

Lesson Summary. This lesson covered how to engage wide, deep, oblique, and widely dispersed targets. The next lesson covers how to engage moving targets.

Lesson 2. ENGAGING MOVING TARGETS

LEARNING OBJECTIVES

1. Identify the key to using the tracking method of engaging moving targets.

2. Identify the key to using the trapping method of engaging moving targets.

4201. Background

Traditional marksmanship training for both riflemen and machinegunners has centered around engaging stationary targets. This type of training is essential for providing primary instruction of basic principles. Unfortunately, many units and individuals never continue their marksmanship training further to learn how to engage moving targets. In combat, few enemy soldiers and vehicles will be cooperative enough to stand still for you while you shoot them. Battlefield targets are most often moving targets. This is true because moving objects and people are more easily detected than those that are stationary. Plus, the enemy will probably have gone to some effort to conceal stationary items.

4202. Training Limitations

For several reasons, including the nonavailability of moving target ranges, many units seldom train either machinegunners or riflemen in moving target engagement. However, the two techniques discussed in the following paragraphs can be practiced in simulated environments during live-fire exercises and field exercises. During live-fire exercises, machinegunners can practice tracking imaginary targets while firing. During field exercises, machinegunners using blanks can simulate engaging targets using both of the following techniques: tracking and trapping. This training will be especially effective if you are using MILES (Multiple Integrated Laser Engagement System) gear.

4203. Tracking Moving Targets

a. The key to this method is your ability to maintain a constant lead on a [illegible] fire and adjusting. A "lead" is the distance in front of a moving target at which you must aim and fire to effectively engage it. Figure 4-4 illustrates the approximate leads you would use to engage individual enemy soldiers. Most of the time enemy soldiers will not move directly across your front. In such case, the lateral speed relative to your line of fire will decrease, thus decreasing your lead.

b. Also, you will make adjustments based on the observed path of your tracers. If your tracer path goes behind your target, obviously your lead was not large enough. If your tracers impact in front of your target, your lead was too large.

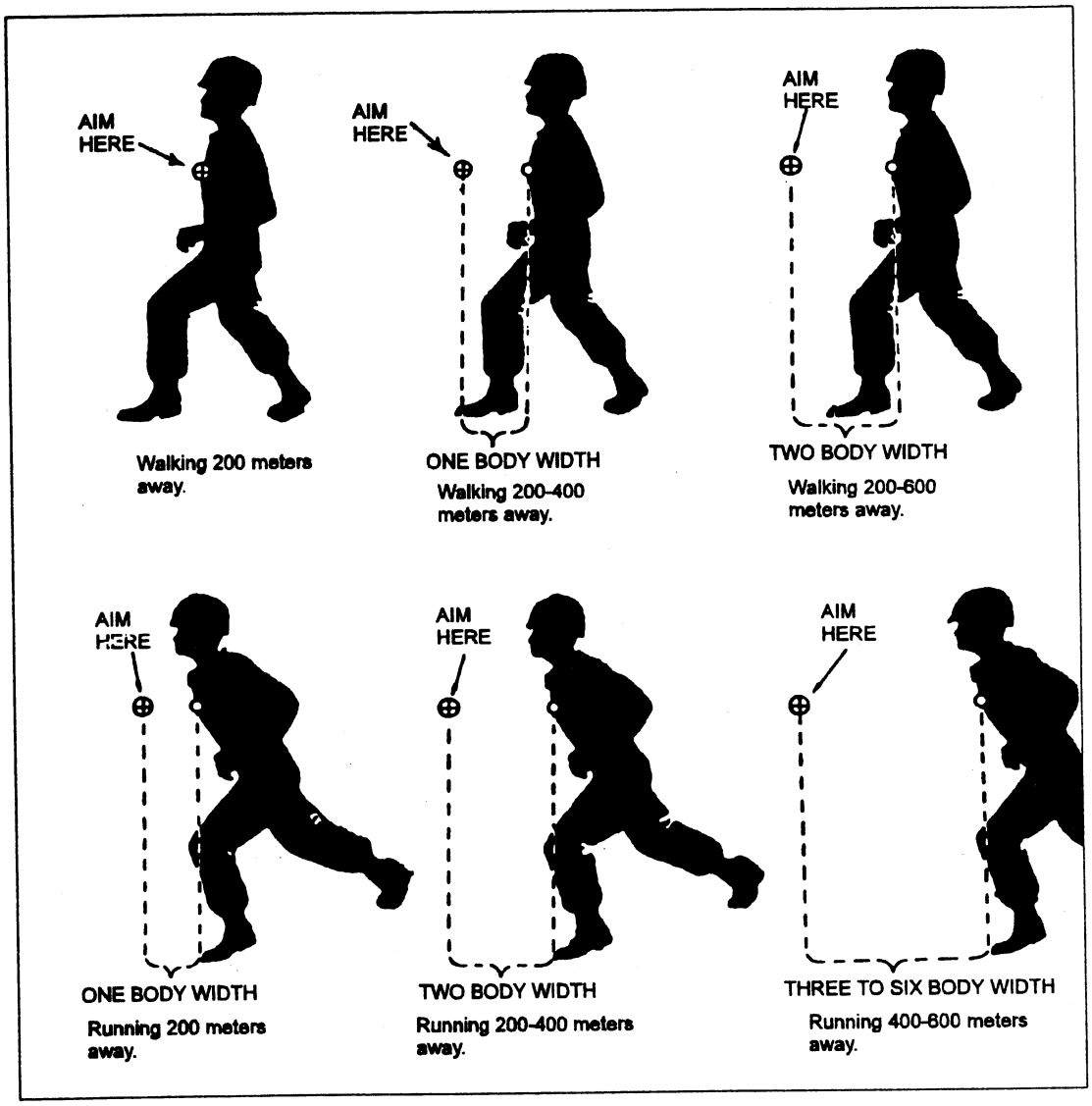


Fig 4-4. Leads.

4204. Trapping Moving Targets

a. The key to this method is your ability to do two things: you must estimate the lead required, and you must hold an aiming point until the target is at the correct distance from your aiming point. Unlike the tracking method, this method requires no movement of the weapon. You simply hold an aiming point and fire the instant you estimate the target to be the correct distance from it. Most enemy soldiers will not afford you the courtesy of moving directly across your front. In those cases, the lateral speed relative to your line of fire will decrease, thus your lead should be decreased. Additionally, your aiming point will have to be slightly higher or lower than your intended point of impact.

b. Adjustments made with this method are based on the same observations of tracer paths and impacts used with the tracking method.

Lesson Summary. In this lesson you discovered the key to tracking and trapping moving targets. In the next lesson you will cover aerial target engagement.

Lesson 3. ENGAGING AERIAL TARGETS

LEARNING OBJECTIVES

1. Identify the rate of fire used to engage aerial targets.
2. Match illustrations of the paths of tracers that missed the target with the correct lead adjustment.

4301. Aerial Targets

Military aviators, both ours and the enemy's, operate on a theory often termed "big sky-little bullet." The pilot feels fairly safe in his aircraft up in the great big sky with little, bitty bullets floating around randomly. The intent of anti-aircraft fire plans is to see just how small we can make this great big sky by adding as many bullets to the sky as possible. If you exercise proper control, most of your fire will be concentrated in the area of the projected path of the aircraft.

4302. Target Engagement

a. The M240G machinegun is not intended to be a primary anti-aircraft weapon system. Your machinegun's fire will be only part of your unit's total fire plan. In this type of fire plan, the main goal is to get as much hot lead up in the air as possible in the approximate path of enemy aircraft.

Most units will adopt the trapping method because of its increased potential for control and massing of fire in one area. All weapons will be fired at the rapid rate to ensure a sufficient amount of fire is placed in the path of the aircraft.

b. You will engage three types of targets: isolated, low-altitude aircraft; slow-moving aircraft; and attacking, high-performance aircraft. High-performance aircraft will probably only be fired upon as part of a larger unit's fire plan. In the case of slow-moving aircraft, you may be the only gunner engaging it. The plane's slow speed and lateral movement may present you an opportunity to fire and adjust several times.

4303. Adjustments

a. Moving targets are difficult enough to hit when they are moving at a constant speed and you can see your rounds impact. The problem is compounded when your target is moving at varied speeds, at irregular angles to you, and you observe no impacts. However, by closely observing the path of your tracers in the close proximity of your target, you can determine the adjustments needed. To be successful, you must follow a couple of basic principles.

(1) Do not waste ammunition firing on targets beyond your range. Distances in the air can be very deceptive. Targets look much closer than they actually are.

(2) Observe the path of your tracers only in the close proximity of your target. Here the paths will appear to be bent or curved. Actually, the paths are straight; it is an optical illusion that makes them appear to be curved (shown in fig 4-5).

(3) Fire at the rapid rate and track your target continually.

(4) Start tracking incoming targets only. Departing or overhead targets will not be in your area long enough for you to adjust your fire.

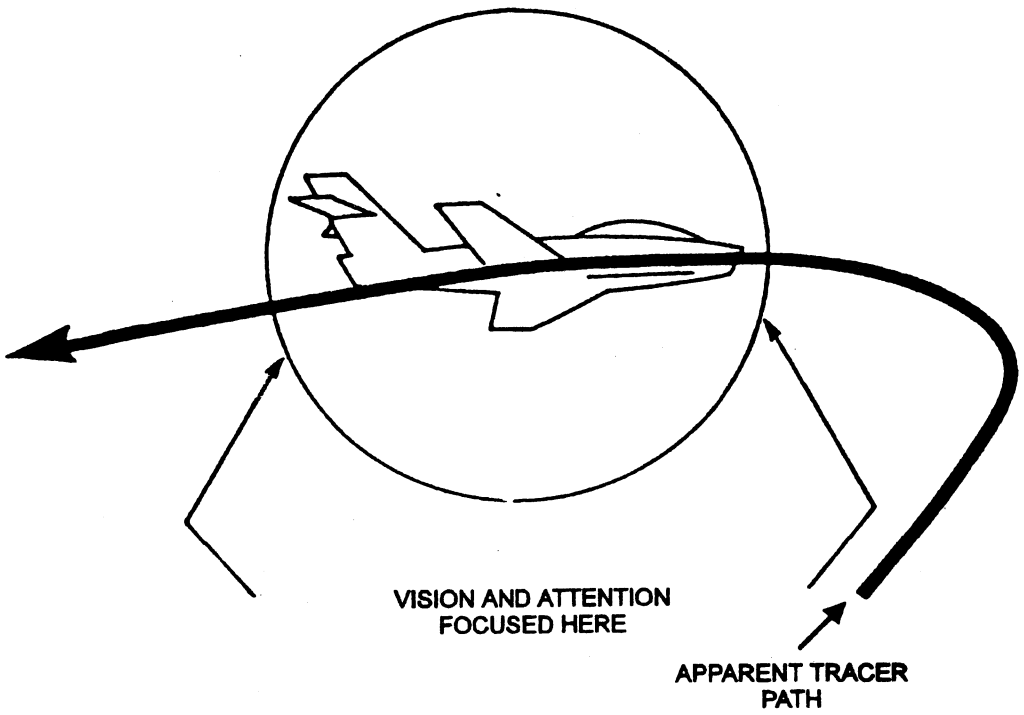


Fig 4-5. The correct point of focus and attention.

b. Figures 4-6 and 4-7 illustrate the tracer path indicators that will provide you with the information you need to correctly adjust onto your target.

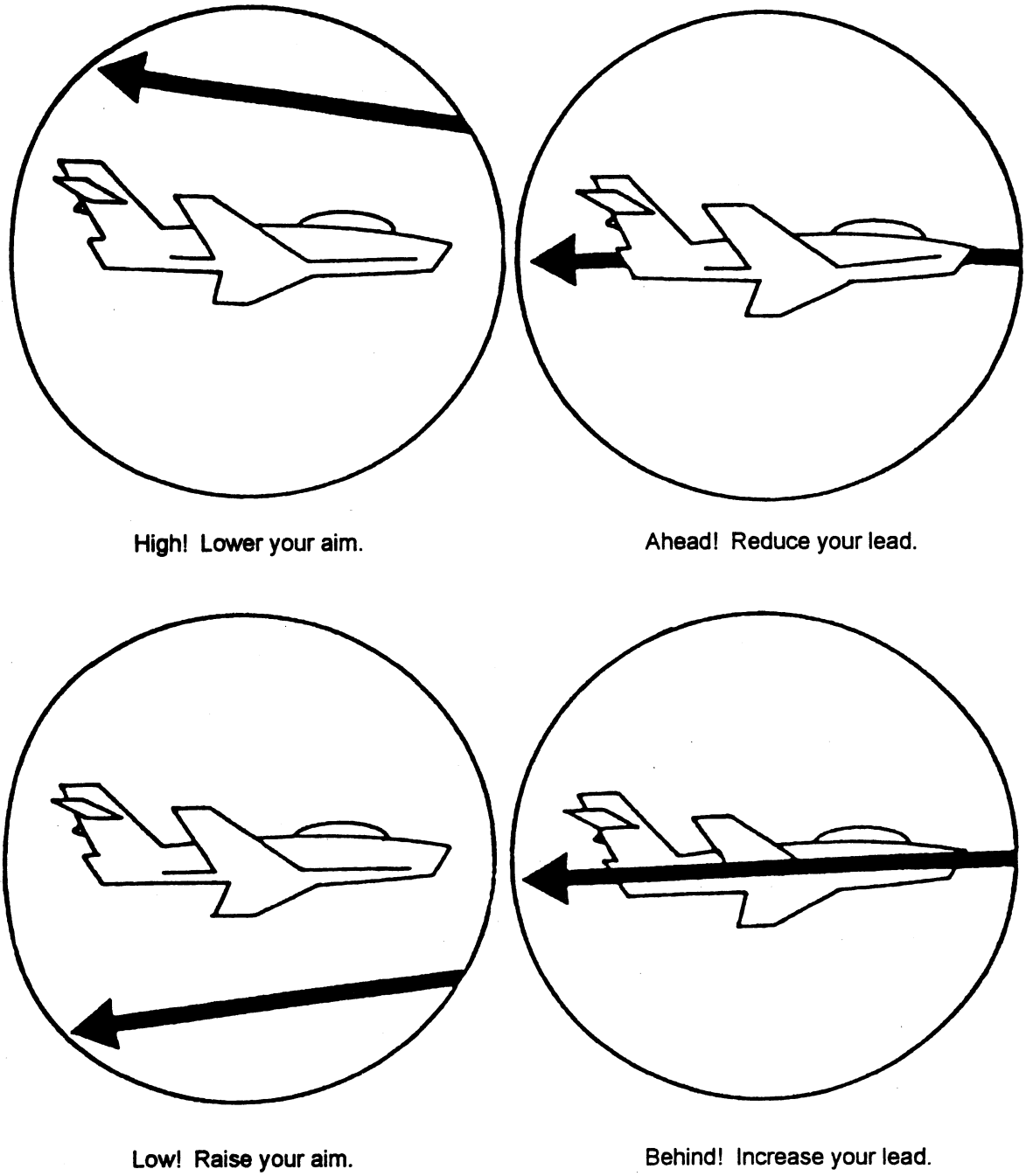


Fig 4-6. View of tracer paths and adjustments on lateral flying aircraft.

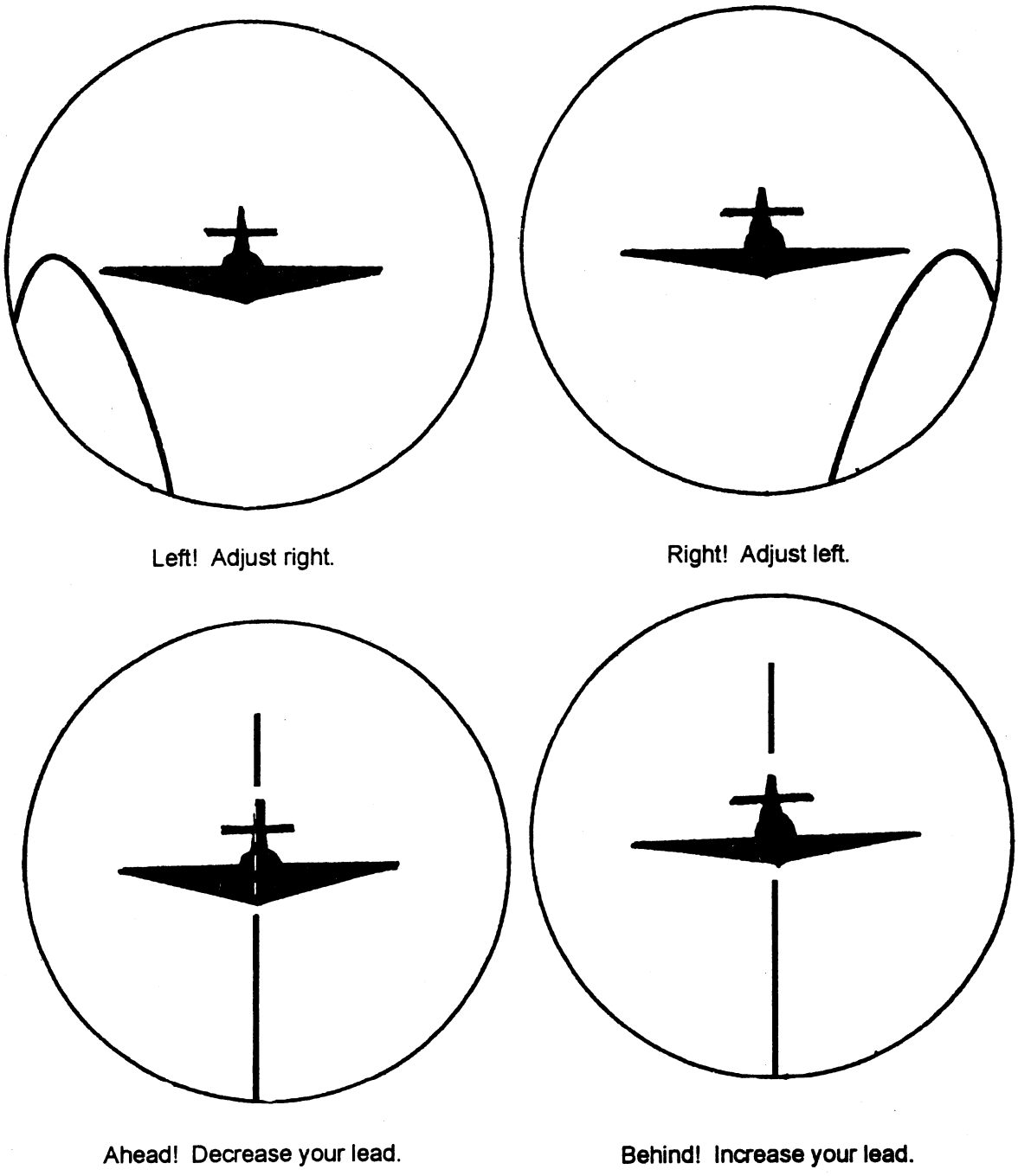


Fig 4-7. View of tracer paths and adjustments on attacking aircraft.

Lesson Summary. This lesson covered how to engage isolated, low altitude, and slow-moving aircraft as well as fast-attacking and high-performance aircraft. In addition, you learned the rate of fire to use when engaging aerial targets. The next lesson covers how to engage targets using indirect fire.

Lesson 4. ENGAGING TARGETS WITH INDIRECT FIRE

LEARNING OBJECTIVE

1. Define initial direction of lay.

2. Identify three methods of establishing initial direction of fire that are used to engage targets from defilade positions.

4401. Engaging Targets While in Defilade

a. Disadvantages. There are several disadvantages to firing in a defilade position.

(1) First, good defilade positions are not often available or usable by your unit.

(2) Second, initial fires and their subsequent adjustments are often inaccurate, creating a need for many wasteful adjusting bursts.

(3) Third, defilade positions require extra security forward to avoid enemy infiltration, creating increased dead space that must be covered by other weapons systems. This requires a good observer be linked to you by wire or radio to make adjustments.

b. Advantages. However, engaging targets while in defilade presents a couple of advantages.

(1) First, it removes you from direct observation and fire, allowing you to move somewhat freely into and around your gun position.

(2) Second, from a defilade position, your exact location can easily remain concealed even after you commence firing.

4402. Initial Direction of Lay

a. Definition. The initial direction of lay is the direction you lay the gun (or aim it) to start a mission.

b. Methods. There are three effective methods:

(1) Reference point

(2) Compass point

(3) Indirect lay/direct alignment

Each method requires an observer to locate the target for you and then pass on the information to lay in the correct direction. In most cases, if the observer is going to make accurate adjustments, he must be very close to the imaginary line between your gun and the target, which is referred to as the gun target line. The relationship of the observer and the gun target line is demonstrated in figure 4-8.

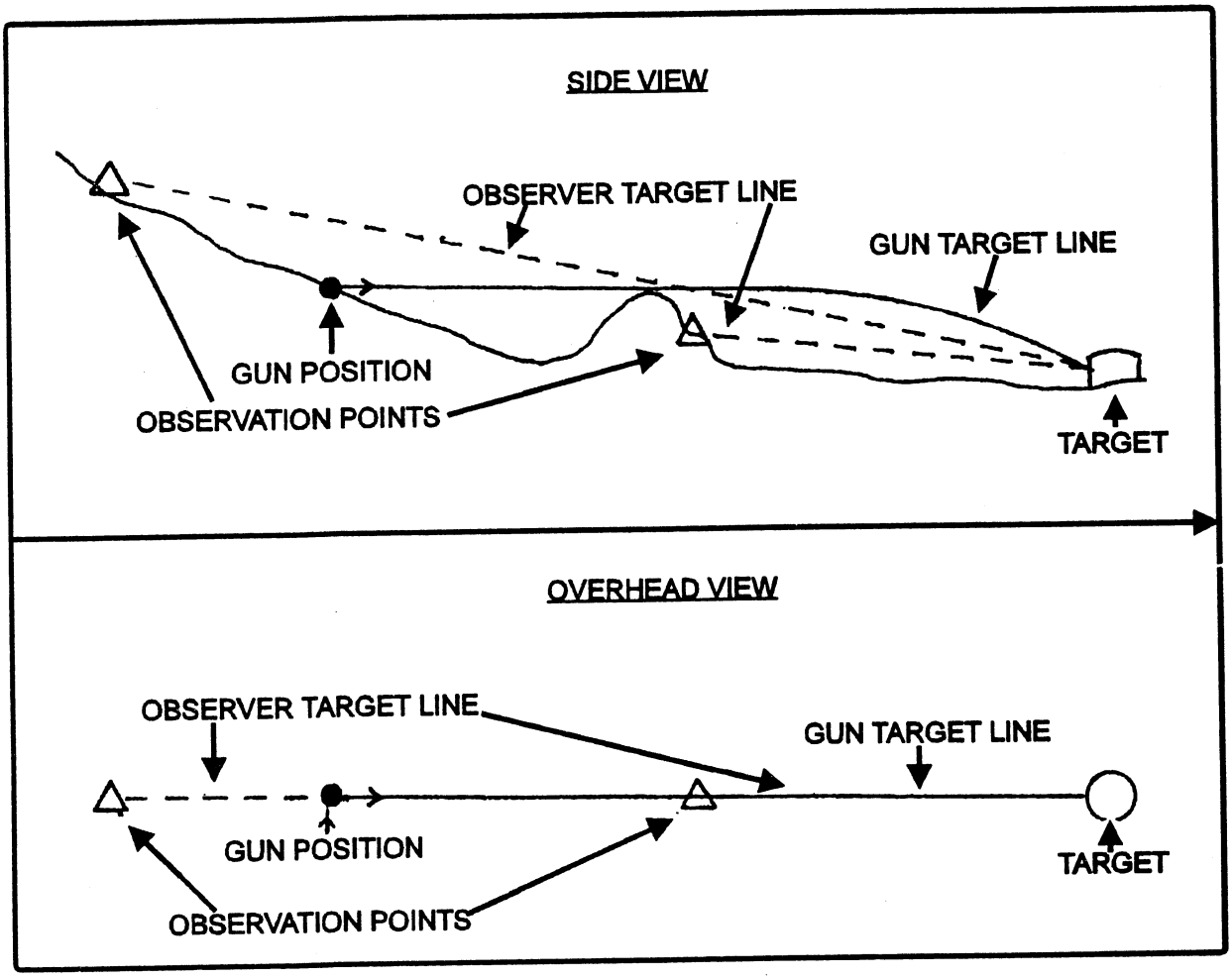
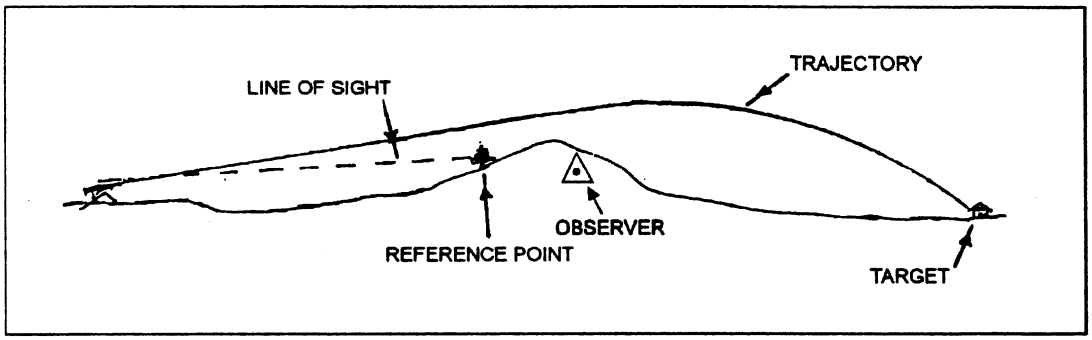
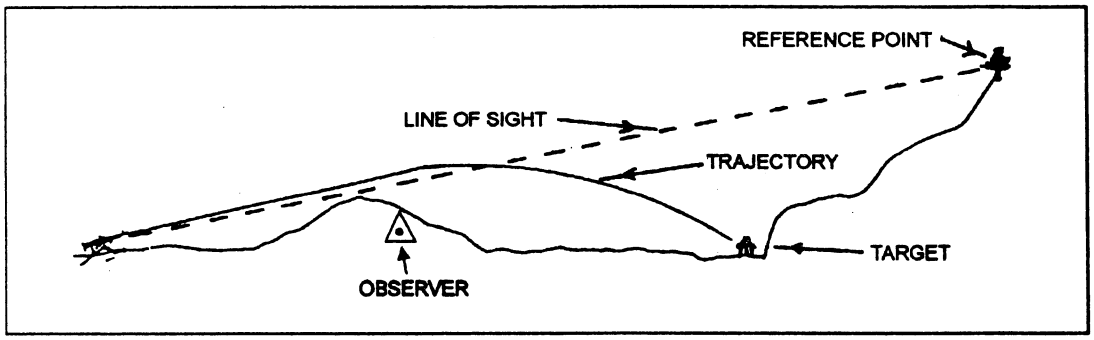


Fig 4-8. Location of observer in relation to gun target line.

c. Reference point. To use indirect fire, both you and the observer must be able to see a common reference point, either on the masking terrain in front of your position, or the background behind the target (see fig 4-9). This reference point can be any easily distinguishable point that can be observed by you and the observer. It could be a lone tree, a large boulder, a far-off peak, or even an aiming stake. As discussed earlier, the observer must be close to the gun target line.



NEAR REFERENCE POINT.



FAR REFERENCE POINT.

Fig 4-9. Reference points.

When using a reference point to establish initial direction of fire, you and the observer must follow the steps listed below:

(1) The observer locates a target and reference point that is close to the gun target line. He must ensure by either prior coordination or observation that you will be able to see the reference point and be able to identify it as being the one he is referring to.

(2) The observer then measures the angle in mils from the gun reference point line to the gun target line by using any acceptable method. These methods include using a compass, a binocular reticle, fingers, map and protractor, etc.

(3) The observer then either issues a fire command if he is one of your machinegun unit leaders, or he passes on the information needed to one of your leaders. In the portion of the fire command for direction, that direction is given in mils left (or right) from the reference point announced.

(4) You fire your first burst as directed. Your first burst will be very long (up to 20 rounds) to ensure your observer is able to track the tracers all the way to the target area and see the impact.

(5) Your observer then adjusts your fire by giving adjustments in mils--up or down and left or right--from your last burst.

d. Compass azimuth. There are two ways to use a compass azimuth to establish initial direction of fire.

(1) The first way to use a compass azimuth to establish initial direction of fire is when the observer shoots an azimuth to the target. He then passes on the direction of the target to the team leader who follows the steps listed below.

(a) Your team leader positions himself a short distance behind your gun and sights through his compass and over your rear sight.

(b) The team leader adjusts himself laterally until the compass is reading the correct azimuth while being aligned with your rear sight.

(c) Next, the team leader directs one of the ammunition bearers to move in front of your gun position approximately 25 meters and place an aiming stake in line with the azimuth.

(d) You then are directed to manipulate your gun until your sights are aligned laterally with the aiming stake.

(e) You fire a long burst on command.

(f) Now make adjustments in mils from your last burst from the correction relayed to you by the observer.

(2) The second way to use a compass azimuth to establish initial direction of fire is when the observer computes the initial azimuth by one of the following methods.

(a) The observer conducts a map study to determine as accurately as possible your position and the position of the target. He computes the direction from your position to the target in mils. This method is not overly accurate but it may be used.

(b) The observer places himself on high ground to your rear and moves laterally until he has aligned himself, you, and the target. He then shoots an azimuth to the target and relays that information to you. This method is illustrated in figure 4-10.

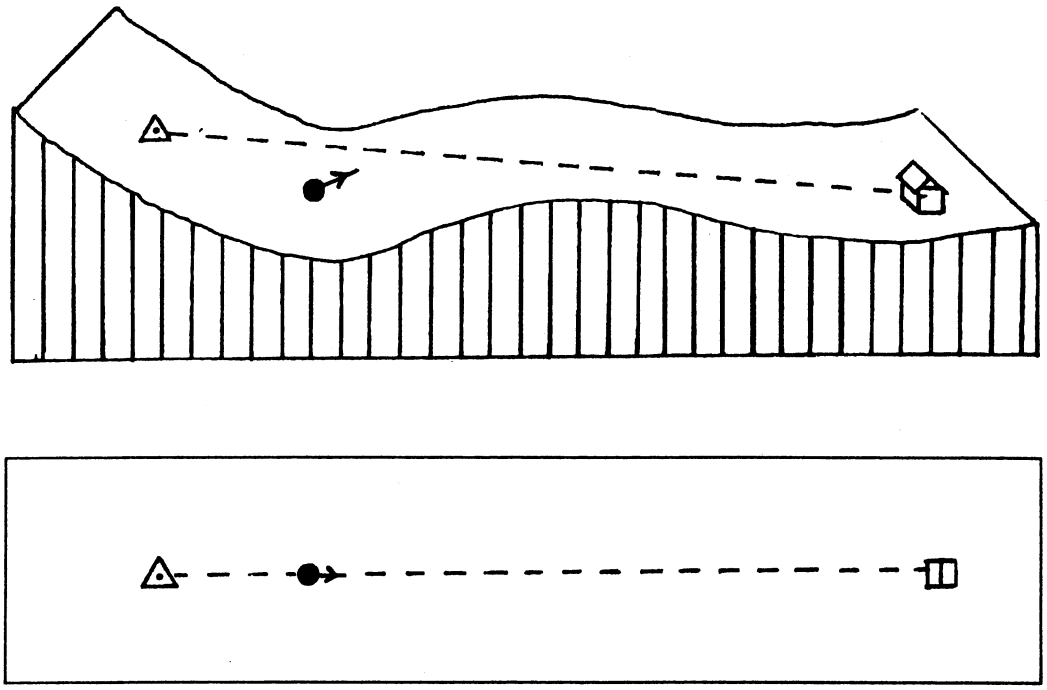


Fig 4-10. Compass method.

e. Indirect lay/direct alignment. This method is simple and accurate. The observer positions himself on or near the crest of the mask in front of the gun and aligns himself with the target and gun. The following steps are used to fire indirect lay/direct alignment, which is illustrated in figure 4-11.

(1) The observer, located on the mask, locates the target and moves laterally along the crest until he feels he is aligned on the proposed gun target line.

(2) The observer then shoots an azimuth to the target and a back azimuth to the gun. If the two azimuths are not equal, he adjusts his position until they are equal.

(3) Next, the observer places an aiming stake at the point where the azimuths were equal. Then he moves over the crest of the mask and out of the line of fire.

(4) Once the observer is clear of the line of fire, you will again fire the long initial burst and await adjustments in mils from the observer.

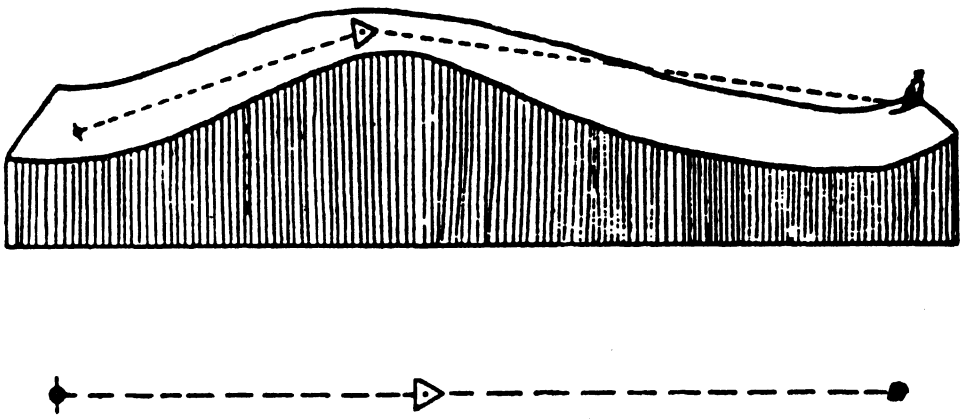


Fig 4-11. Indirect lay/direct alignment.

?	Do you remember the three methods of establishing initial direction of fire used to engage targets from defilade positions? If you said "Reference point, compass azimuth, and indirect lay/direct alignment," you are correct! Do you remember what they mean? If not, reread this lesson before proceeding.

Lesson Summary. In this lesson you saw how to engage targets using indirect fire. You learned the disadvantages and advantages of indirect fire and the three ways to obtain initial direction. The next lesson covers firing overhead of friendly troops.

Lesson 5. FIRING OVERHEAD OF FRIENDLY TROOPS

LEARNING OBJECTIVES

1. Identify the safety precautions to use when firing overhead of friendly troops.

2. Identify what can be used as a muzzle or depression stop to avoid having a muzzle depressed too low during overhead firing.

4501. Background

One of the most elementary offensive principles used in the attack is based on using a maneuver unit and a base of fire. The time-tested use of fire and maneuver can be traced back to archers and swordsmen attacking castles. It is logical and simplistically practical. The most desirable

form of fire and maneuver is the envelopment. However, terrain and enemy dispositions do not always allow for this scheme of maneuver. In such cases, the frontal assault may be the only alternative available. In frontal assaults, positioning the base of fire often causes problems. One solution to the dilemma is for the base of fire to fire overhead of the assault force. Often, defending forces will make their stand on elevated ground. This is an ideal situation for overhead fire support.

Unfortunately, if overhead fire is not sufficiently controlled, it may result in the base of fire actually assisting the defenders by either limiting the advance of your own assault elements, stopping the momentum of the attack, or worse, inflicting friendly casualties. To avoid all of these problems, the attacking unit's commander must provide close coordination and implement strict safety limits.

4502. Gunner's Rule

a. Gunners rule. The Marine Corps has only one method approved to establish safety limits for overhead fire for training. It is a simple and effective system that has been devised to allow you to quickly and effectively establish a safety limit for your fires. It is called the "gunner's rule."

b. When to use gunner's rule. You should only use the gunner's rule when your gun is tripod-mounted and firing at ranges between 350 to 850 meters. There may be a temptation to use free gun on targets that are very large, but avoid this practice. However, swinging traverse can be safely used. If the target should happen to be very deep, you may be directed to use both guns in the squad to fire the mission. The target will be divided--one gun taking the lower half and the other the upper half. The rear elements may simply be ignored and left to other weapons.

c. Application. To apply the gunner's rule, follow the steps listed below:

(1) Determine the range to target and set the rear sight.

(2) Lay your gun on the target.

(3) Raise the rear sight to 1500 meters.

(4) Look through the sight and note the point where the new line of aim strikes the ground. This is the Overhead Safety Limit--the point where friendly troops can safely move up to and the point where **fires must cease as friendly troops approach or cross.**

(5) Mark this area using a target reference point or some visual aid to ensure positive identification.

(6) Reset the rear sight to the original range to target.

Warning: **Remember, you must cease fire when friendly troops approach or reach the Overhead Safety Limit.**

d. Safety precautions for overhead fires.

(1) Refer to MCO P3570.1A concerning overhead firing for more detailed information.

(2) Never use ammunition marked for training only for overhead fire.

(3) Do not fire overhead fire through trees or brush that are likely to deflect rounds.

(4) Do not fire crisscrossing fires from two guns overhead of friendly troops.

(5) Ensure that all members of the gun team are aware of the location of the safety limits and sectors of fire.

(6) Do not use tracer ammunition if the range to the safety limit exceeds 750 meters. Tracer trajectories become unpredictable at this point.

(7) See Table II in Appendix B, "Overhead Fire - How To Use."

4503. Muzzle/Depression Stops

a. Definition and purpose. Beyond the establishment of a safety limit, the single most important safety precaution that can be used in overhead fire is a muzzle or depression stop. A muzzle or depression stop is some object or device which will not allow you to lower the muzzle of your gun beyond a certain limit. The depression stop will normally be positioned to allow the muzzle to be depressed only to within 10 mils of the safety limit. The 10 mil buffer is established by aiming in on the safety limit and then elevating the muzzle 10 mils or 10 clicks. It is at this point of elevation that the stop will be inserted under the muzzle (shown in fig 4-12).

b. Suitable objects. Some objects make very good muzzle or depression stops and others do not. The following list contains objects that make good stops.

(1) Logs that are large in diameter (at least 10 inches)

(2) Sandbags (at least two bags thick)

(3) Heavy metal beams, like railroad track (at least 3/4-inch thick)

c. Unsuitable objects. Some objects make poor muzzle or depression stops. The following is a list of some of these.

(1) Rocks and masonry. The ricochets and clipped-off rock particles from defender's fires can be more dangerous than his actual rounds.

(2) Dirt piles. To be effective, a stop should offer some gun crew protection and be rigid enough to completely stop the muzzle from being depressed.

(3) Strands of wire and boards attached to stacks are just not strong enough.

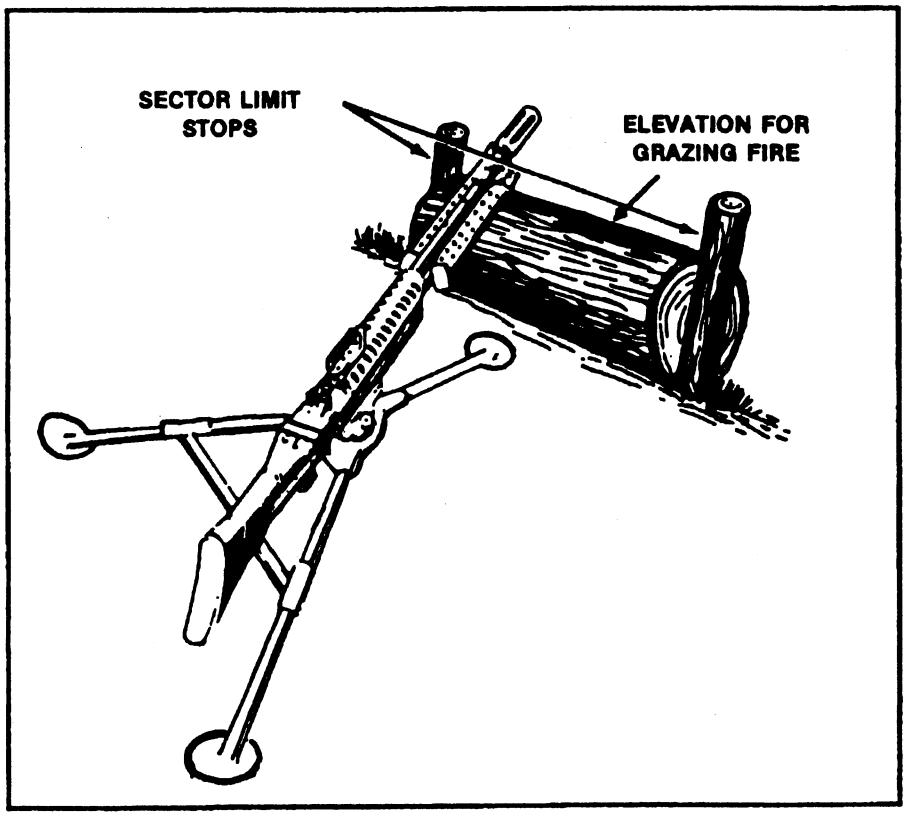


Fig 4-12. Muzzle or depression stop in place.

Lesson Summary. In this lesson, you learned how to fire overhead of friendly troops using the gunner's rule. You learned what objects can be used for a muzzle stop or depression stop and what objects not to use. In the next lesson you will see how to engage targets using predetermined targets.

Lesson 6. ENGAGING PREDETERMINED TARGETS

LEARNING OBJECTIVES

1. Identify the information needed from your unit leader to lay the M240G for Final Protective Line (FPL).

2. Identify the information needed from your unit leader to lay the M240G for Principle Direction of Fire (PDF).

3. When given an illustration of a T&E mechanism, read the correct elevation and direction readings from it.

4. Identify the correct list of components used on a range card.

5. When given a description of a defensive position, construct a range card that includes a principle direction of fire.

6. Identify three field expedient methods of laying a machinegun for predetermined fire.

4601. Definition and Use of Predetermined Fires

Predetermined fires are those fires that should not require any, or at least very minor, adjustments to get hits on target. This is possible because you will have laid on the target in advance and recorded or established the gun data for each target by one of several methods.

The tripod method is the most accurate means of laying the gun for predetermined fire, but the accuracy of any predetermined fire can be greatly increased by firing and registering rounds on the target vice just aiming at it. However, due to the tactical situation, this may not always be possible.

4602. Laying for Final Protective Line (FPL)

In the defense, machineguns are assigned an FPL. The goal of an FPL is to deploy the unit's machineguns in positions that allow each gun's grazing fires to interlock with one another and present the assaulting enemy with an impregnable band of hot lead in front of the position. FPLs are graphically represented as a solid line with the arrow in the direction of fire. This type of defensive plan is illustrated in figure 4-13.

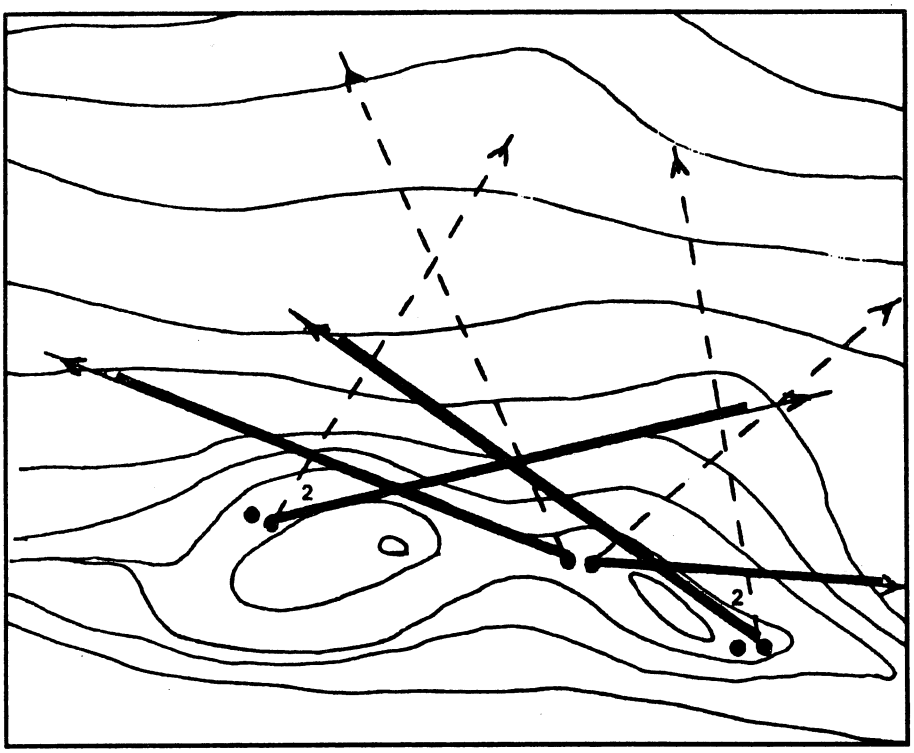


Fig 4-13. Defensive fire plan stretch using FPLs.

a. Determining the laying of the gun. Normally when you get to your defensive position, one of your unit leaders will designate an approximate position for your team leader to deploy the gun and will give him certain information about the sector of fire for your gun team. Your team leader will, in turn, direct you to physically place the gun and pass on the information received from the unit leader. This information will enable you to lay the gun. This information should include the following:

(1) Physical location on the ground of the gun position. This position should be somewhere that provides as much cover and concealment as possible while still allowing the gun to cover the assigned sector of fire.

(2) The left and right lateral limits of your sector of fire. These should not exceed 800 mils in width.

(3) Which sector limit will contain the FPL. The FPL is always placed in one of the two sector limits. The sector limit should be over flat ground or uniformly sloping ground for ranges up to 700 meters. The irregularities in the ground and the nature of the slope of the ground often create areas along the FPL that grazing fire will not cover (demonstrated in fig 4-14). These areas are called "dead space."

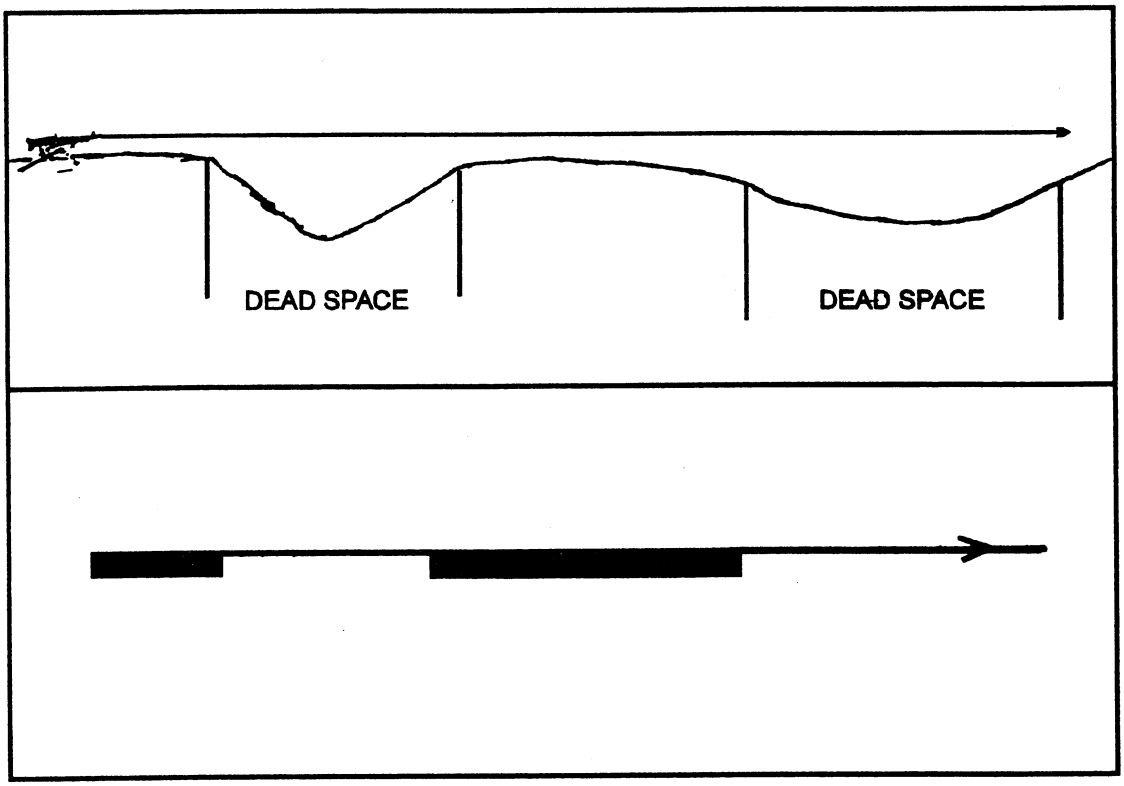


Fig 4-14. Dead space.

Note: If the ground is so irregular or sloped so steeply that the total length of dead space is greater than the total length of graze, consider another method of emplacement.

(4) What squads or guns are located on your right and left.

(5) The locations of alternate and supplementary positions.

(a) An alternate position is used to accomplish your mission when your primary position becomes untenable.

(b) A supplementary position is used for a different mission and would be stated as such in your defensive operations order.

b. Actual laying of the gun. After you have your defensive orders, the actual laying of the gun begins. Once you have decided on the exact spot for the tripod, assemble the gun and T&E mechanism onto it and follow the steps below.

(1) Slide the T&E mechanism all the way to one side of the traversing bar and lock it in place with your machinegun pointing in the general direction of the FPL. If the FPL is the right limit of your sector of fire, slide the T&E mechanism all the way to the

left. Likewise, if the FPL is the left limit of your sector of fire, slide the T&E mechanism all the way to the right. This will enable you to traverse your gun more than 800 mils across your sector of fire. This will also aid you in laying rapidly onto the FPL, since all you will have to do is release the traversing slide and swing it all the way to one side of the traversing bar.

(2) Lie down behind the gun.

(3) Set your sights to the range setting that you estimate is the maximum range that grazing fire can be fired from your present position.

(4) Looking through the sights, shift the tripod legs until the sights are aligned with the FPL.

(5) Look at the gun and adjust the level of the gun as best you can by digging in one or more of the tripod legs. Try to avoid placing things under the feet of the tripod to raise them. This makes the tripod less stable and raises the silhouette of your entire position, making it more difficult to camouflage .

(6) Once the gun is as level as you can estimate by eye, check the alignment on the FPL. If it needs correction, adjust it by further shifting the tripod legs, not by moving either the traversing knob or the traversing slide.

(7) Determine the correct elevation by looking through the sights and adjusting the elevation handwheel either up or down until the sights are aimed on the correct point of aim, which normally would be a point on the ground 700 meters away. If the ground is not level or evenly sloping, this point of aim may not be easily identified. You may have to use an alternate aiming point. Select a range setting that is appropriate for the range to your alternate aiming point and an elevation setting that does not cause the rounds to rise above the ground more than two meters at any point. This is a point 4 mils above the ground at 500 meters range.

(8) Finally, check the T&E mechanism for freedom of swing across the entire length of the traversing bar and sight along the side of the barrel for an unobstructed line of fire in your sector of fire.

4603. Laying for Principle Direction of Fire (PDF)

a. When to use PDF. Your unit leader decides to use a principle direction of fire (PDF) in a defensive plan, he will literally direct you to lay your machinegun in a manner that will stop an attack, by covering the most feasible avenues of approach. Leaders will usually use this means of emplacement as an alternative to using an FPL. You will use a PDK in terrain that is broken up with short ridges, draws, and irregular slopes to the point where a reasonable amount of grazing fire cannot be fired. Grazing fire that does not interlock with other guns or that only extends halfway across your unit's front is of little value. However, these irregularities in the

terrain usually provide for ease in identifying the most feasible avenues of approach of an assault because they provide the enemy with cover and concealment. Additionally, this type of terrain causes the enemy's assault to be channeled into narrow formations with their long axis being aligned with their direction of movement. This allows your gun's beaten zone to be enfilade, or in line, with them. This all boils down to them charging right into your muzzle, one behind the other, as illustrated by figure 4-15.

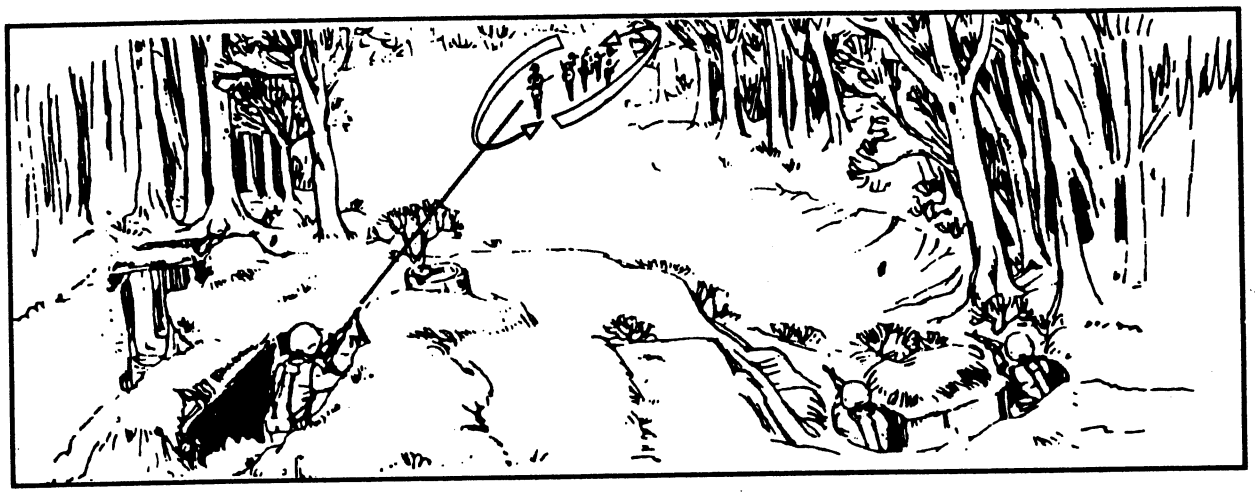


Fig 4-15. Fires down avenues of approach.

b. Receiving your defensive orders. Once you have arrived at your defensive position, your team leader will pass on information about the sector of fire for your gun team and direct you to physically place the gun at a certain location. This information should include the following:

(1) The physical location on the ground of the gun position. It should provide as much cover and concealment as possible while still covering the assigned sector of fire.

(2) The left and right lateral limits of your sector of fire.

(3) What is to be used as the PDF. This will usually be something like a road or trail, a draw or a ridge, a break in the vegetation, or some other area that provides for cover of movement and rapid mobility. Whatever is selected will depend on the makeup of the terrain and your knowledge of the past habits of the enemy.

(4) The identity and location of squads or machineguns located on your right and left.

(5) The location of your alternate and supplementary positions.

c. Laying your machinegun for a PDF. After you receive your defensive orders, lay your machineguns as before and follow these steps:

(1) Lay the gun in on target with the T&E mechanism at 0 mils.

(2) Slide the T&E mechanism all the way to one side of the traversing bar and lock it in place with your machinegun pointing in the general direction of one sector limit. If your gun is pointing in the general direction of the right limit of your sector of fire, slide the T&E all the way to the left. Likewise, if your gun is pointing in the general direction of the left limit of your sector of fire, slide the T&E all the way to the right. This will enable you to traverse your gun more than 800 mils across your sector of fire.

(3) Lie down behind the gun.

(4) Looking through the sights, shift the tripod legs until the sights are aligned with the sector limit you are using for your initial lay.

(5) Adjust the level of the gun as best you can by digging in one or more of the tripod legs.

(6) Once the gun is as level as you can estimate by eye, check the alignment on the sector limit. If it needs to be corrected, adjust it by shifting the tripod legs, not by moving the traversing knob or traversing slide.

(7) Release the traversing slide and swing the gun all the way to the opposite sector limit. If you cannot reach that sector limit, you must notify your unit leaders that they have assigned you a sector that is too wide. They will either instruct you to engage the portion that is too wide by free gun fire technique, or adjust your sector limits.

(8) Slide the traversing slide back across the traversing bar until it is aligned with the PDF.

(9) Adjust your sights to the correct estimated range and manipulate the elevating handwheel until the best coverage of the avenue of approach is attained.

(10) Finally, check the T&E mechanism for freedom of swing across the entire length of the traversing bar, and sight along the side of the barrel for an unobstructed line of fire in your sector of fire.

What is principle direction of fire (PDF)? What is final protective line (FPL)?

Did you say PDF are predetermined fires? Did you say PDF is used at the most feasible avenue of approach where more concentrated fire is best?

Did you say FPL is an interlocking wall of steel (when grazing fire is best used)?

Great! Continue.

4604. Reading the Traversing and Elevation (T&E) Mechanism

a. General. Many Marines are confused about the purpose of recording gun data from a T&E mechanism. Often, it is thought of as a means of engaging every target in your sector at night. This is only possible when the battlefield is illuminated. Usually, only the PDF or FPL and one or two other Target Reference Points can be used with any real accuracy at night off the readings of a T&E mechanism. The T&E mechanism is not illuminated and cannot be read well at night unless you have illumination. Therefore, you may use a flashlight (RED OR BLUE LENS), or some other illuminating device when this is the only means of laying the weapon on the target.

However, there are a number of ways to mark a few targets on a T& E mechanism. Examples include using small strips of luminous tape or driving short stakes into the ground underneath the traversing bar. In most tactical situations, the best policy is always to leave the gun laid on the FPL or the PDF at night. Usually, because of security, your unit leaders will not want you to fire at night until the entire unit's FPL is fired. If the enemy does not know where your automatic weapons are located prior to starting his assault, and you have carefully selected your locations, it is highly probable that the enemy will assault directly into your beaten zones, which soon become killing zones.

If you are in a reverse slope defense and firing from positions defilade, or there is light but poor visibility, predetermined fire from gun data recorded off the T& E mechanism can be devastating to the enemy. Here is how to read and record gun data from a T&E mechanism:

b. How to read and record gun data from T&E mechanism. You must actually read three scales. The direction readings come from the traversing bar scale. The elevation readings are obtained by reading the engraved scale on the upper elevating screw and the elevating handwheel are obtained by reading the engraved scale on the upper elevating screw and the elevating handwheel scale (see fig 4-16).

c. The most accurate target data that you can get comes as a result of firing and adjusting until you have impacts on target and then recording the data on the gun. Unfortunately, the tactical situation rarely allows for this. However, very accurate data can be derived from your gun if you have properly zeroed your sights and can estimate range fairly well. To obtain correct data for a target, follow the steps below.

(1) Ensure the offset head is centered on the traversing screw. Ensure the index line is aligned with the zero on the traversing handwheel scale. In accordance with your range estimate, ensure you have set the correct elevation on the rear sight.

(2) Aim at the target and get a good sight picture.

(3) While maintaining the correct pressure and sight picture, lock the traversing slide in place.

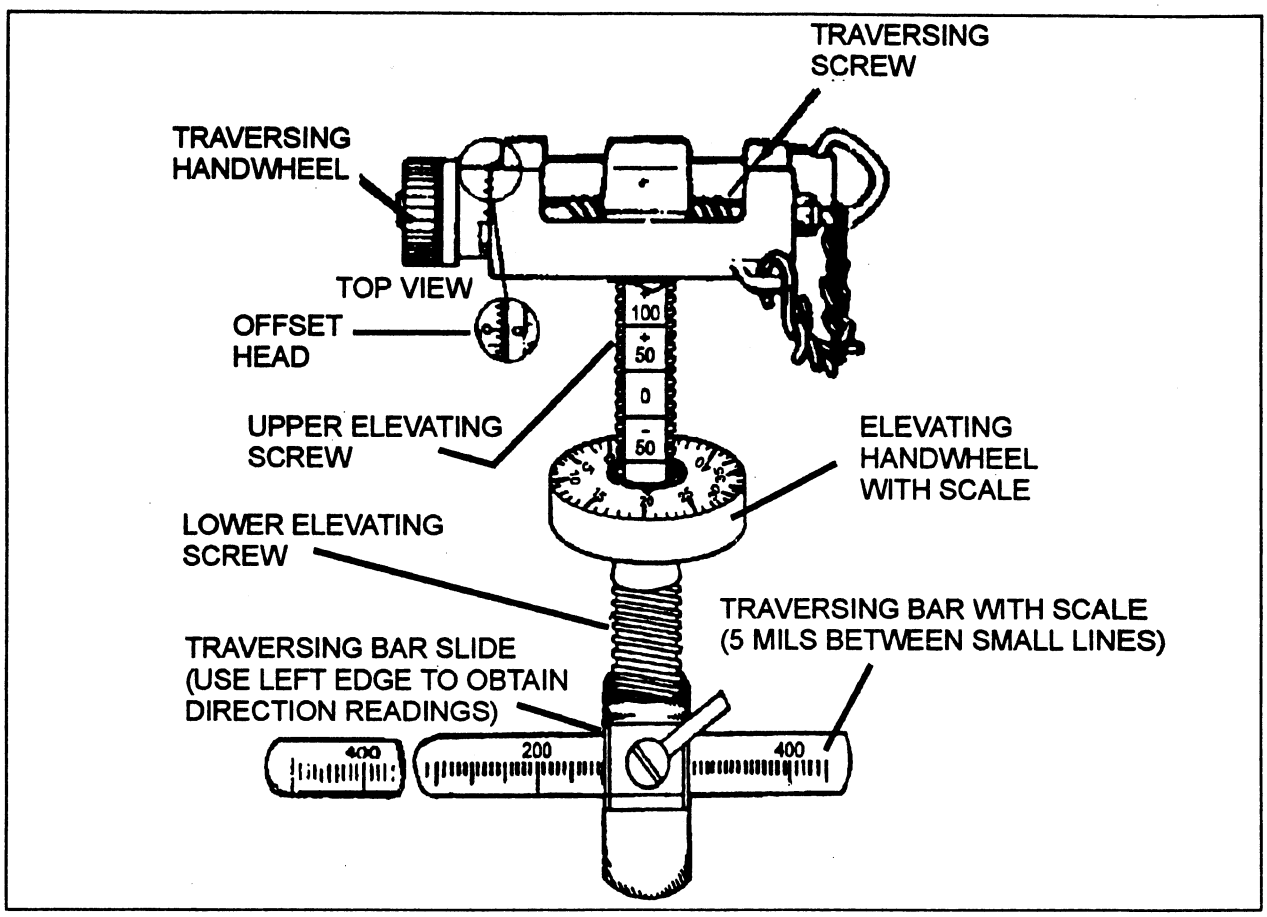


Fig 4-16. Traversing and elevation mechanism (T& E).

(4) Read the direction by observing the left edge of the traversing slide and the traversing slide scale. If the left edge of your traversing slide is to the left of the zero mark, you have a right direction. If the right edge of your traversing slide is to the right of the zero mark, you have a left direction. (Direction is determined by the direction of the muzzle.) You will record the direction to the first visible 5 mil line. Do not worry about whether the traversing slide falls between two marks because there is more than 5 mils play in the T& E mechanism.

(5) You obtain the elevation reading by using two scales. Each of the two parts of the readings are separated by a slash. You will first read the elevation scale on the upper elevating screw plate, which is graduated into 50 mil increments from -200 mils to + 200 mils. There is an index line below each number and a plus (+) or minus (-) sign above each number, with the exception of zero (0).

(a) Your first portion of reading is the first complete number observed by laying directly behind the gun and looking over the flat surface of the handwheel. You must include the plus (+) or minus (-) sign as well as the number. Using figure 4-17, your first part of the reading would be minus 50 (-50).

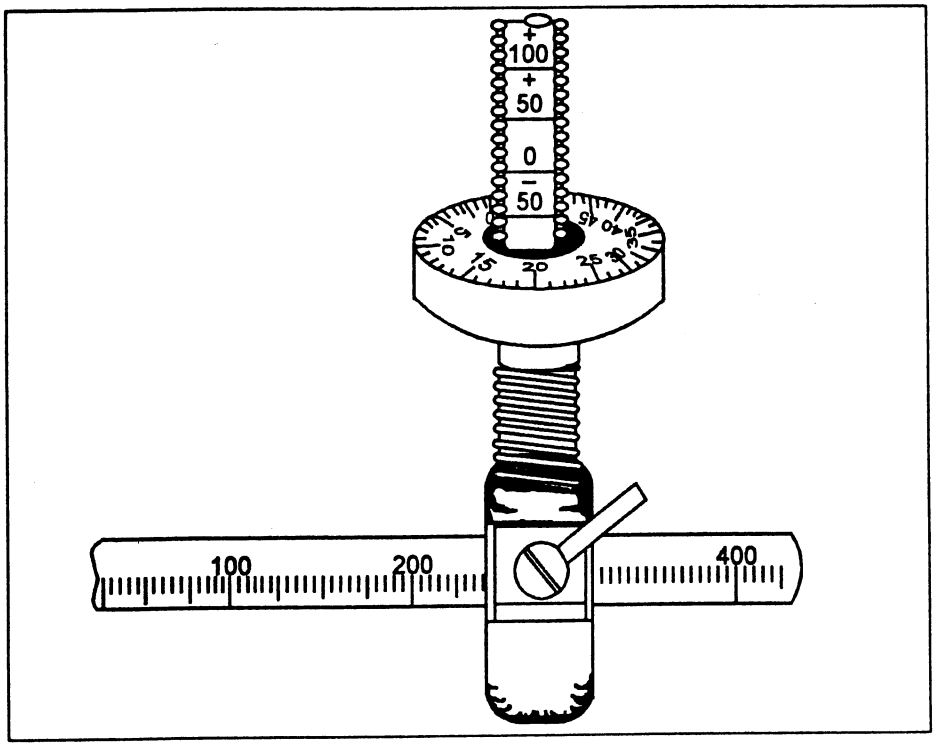


Fig 4-17. Left 250, -50/20 (L250, -50/20).

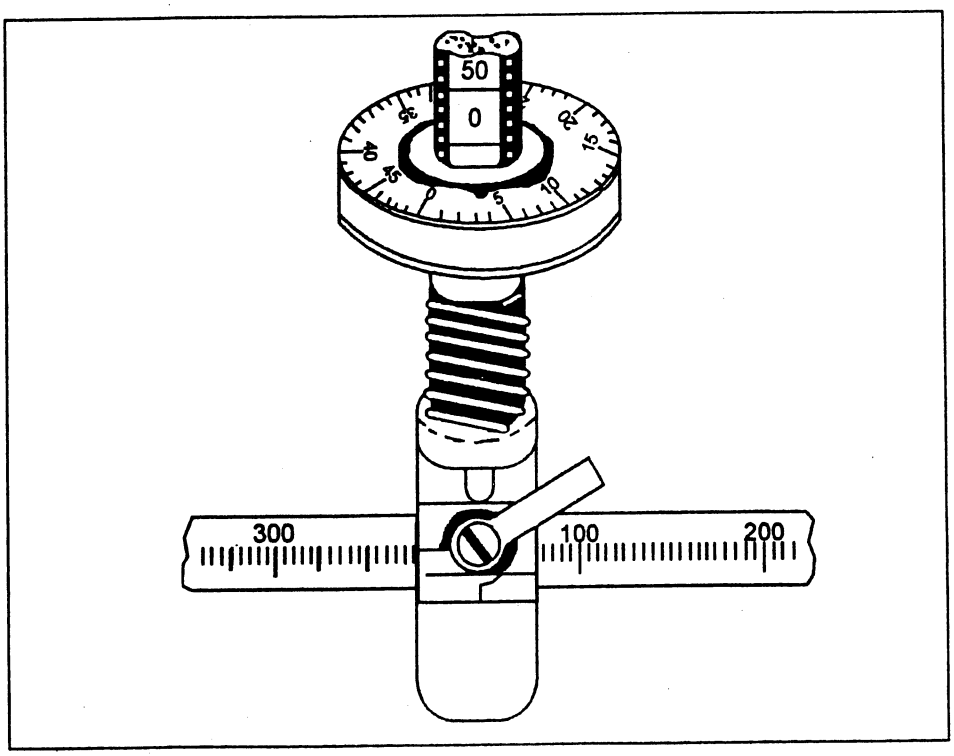


Fig 4-18. Right 225, +0/34 (R225, +0/34).

(b) Your second part of elevation reading comes from the scale on the elevating handwheel, which is graduated into 1 mil increments for a total of 50 mils. Locate the graduation on the line with the indicator. In figure 4-17, the second portion of the reading would be 20. When you record the elevation data, it will look like this: -50/20.

d. Observe figures 4-17 and 4-18 for left and right reading.

4605. Range Cards, Final Protective Line (FPL)

a. Uses of range cards. Once your machinegun team is deployed in a defensive position and the gun laid, the first thing you should do as the gunner is complete two sets of range cards. These cards are very important and are used for several purposes. One copy is forwarded as soon as possible to higher headquarters, usually to the company level, via your chain of command. This range card will become the basis for the company's fire coordination plan. All supporting fires, security sectors, and defensive coordination will be planned using your machinegun's fire as the base from which to build. The second copy you keep for use by you or other members of your gun team to fire at predetermined targets or to facilitate range estimations to other targets. Give this card to the unit relieving you to facilitate the employment of their guns. Finally, units which are sending out patrols will want to look at your range card to see where your final protective line is. (The FPL is the FPF written on the range card, when the name is changed to FPL.) They will want to know where dead spaces are to ensure they are clear of infiltrators.

b. Completion of range cards. With so many people using your range card, it should be obvious to you that it must be neat, clear, and prepared according to a universal format. Observe figure 4-19 for components (1) through (5) and figure 4-20 for components (6) through (9). Each component is explained below for correct completion of your range card.

(1) Sector limits. The sector limits are drawn as broken lines ending in arrow heads. If you are using an FPL, only one sector limit will be drawn because one is located in the same location as the FPL.

(2) Weapon symbol. Figure 4-19 shows the correct symbols for a light machinegun (which is a single dot with a solid arrow extending out in the direction of the FPL or PDF), a medium machinegun (which is the same symbol, but with a bar across the arrow line), and a heavy machinegun (with two bars across the line). The dot in all the symbols represents the location of the gun. The magnetic azimuth of the FPL or PDF will also be recorded along this line.

(3) Magnetic north arrow. This arrow is drawn from the dot that represents the gun position. The arrow is drawn to indicate the direction north. The arrow is drawn from the gun position as if you were looking out towards your sector of fire. The correct symbol for north is an arrow with a single barb.

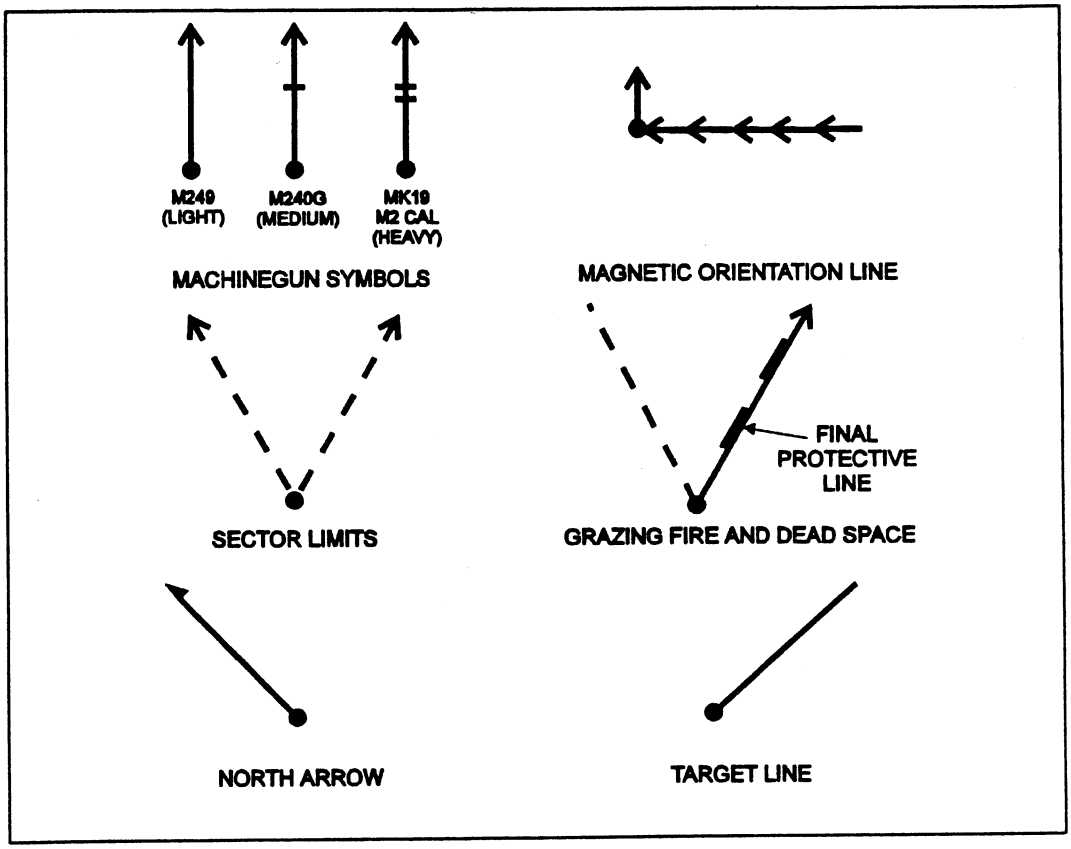


Fig 4-19. Range card symbols.

(4) Magnetic orientation line and location grid coordinates. These are means by which other Marines can positively locate your gun position. The magnetic orientation line is a line drawn from a prominent terrain feature that is located preferably behind your friendly lines. The magnetic orientation line is a single solid line drawn from the terrain feature to your gun position. This line has several arrow heads pointing in the direction of your gun position. Recorded next to this line is the magnetic azimuth from the terrain feature to your gun position. The grid coordinates of your gun position are recorded next to the dot in the machinegun symbol.

Note: You only need to use one of the two methods described in (3) and (4) to locate the position of your gun.

(5) Grazing fires and dead space. If an FPL is used, a heavy shaded area drawn along the inside of the FPL will indicate the limits of grazing fire obtainable. Any dead space is indicated by breaks in the grazing fire shaded areas. The near and far limits of the dead space is recorded in meters of range next to the ends of the shaded areas.

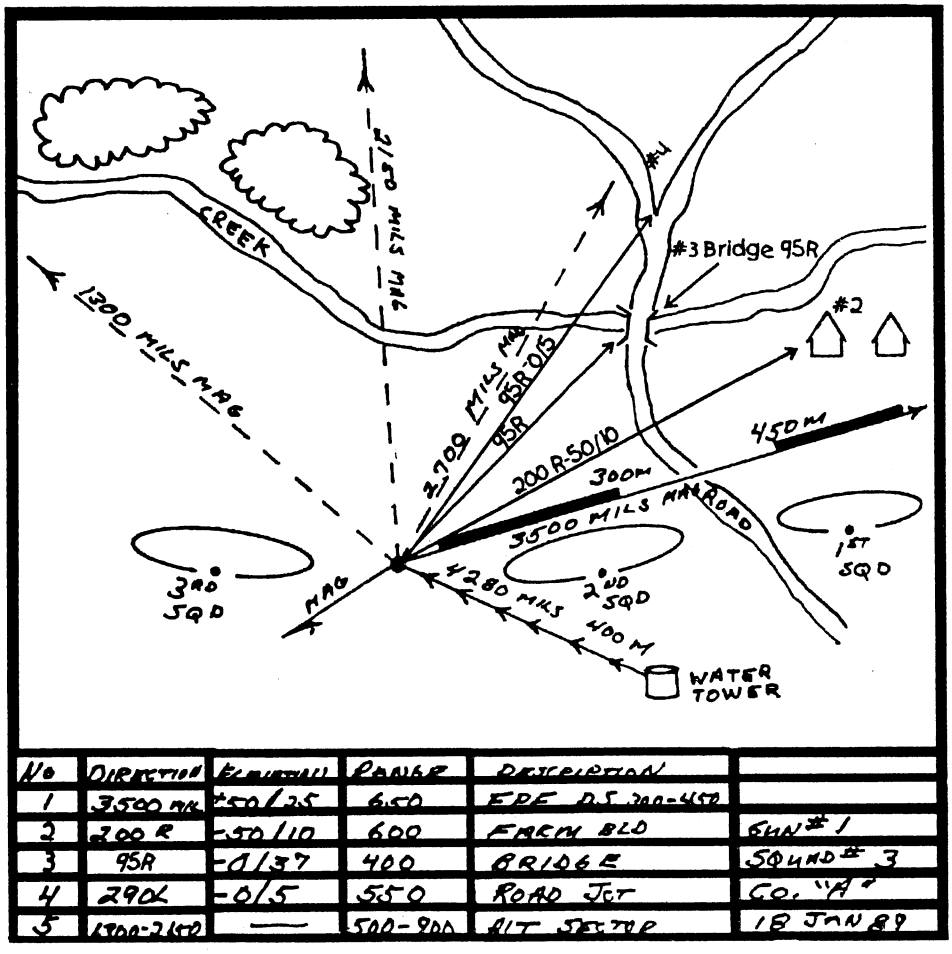
(6) Gun identification block. In this block, identify what gun the card was drawn for and on what date it was drawn. For security reasons, your unit should only be identified at company level.

(7) Terrain features. Draw only those terrain features that significantly add to the clarity of the range card. Terrain features should be drawn to the correct perspective.

(8) Location of friendly troops or equipment. Friendly positions or equipment in or very near your sector limits should be drawn and clearly labeled with a description, range, and direction.

(9) Targets. Draw targets to perspective and label with a number. The number one target will be either the FPL or the left sector limit. If the FPL is on the right sector limit, all other targets are sequentially numbered from right to left. At all other times, targets are numbered from left to right.

The Marine Corps uses two different methods of recording target data. One method records data directly on the sketch along the line leading to the target. The other method uses a data block at the bottom or reverse side of the range card.



No	Direction	Elevation	Range	Description	
1	3500 MAG	+50/25	650	EDE D.S 300-450	
2	200 R	-50/10	600	FARM BLD	GUN #1
3	95R	-0/37	400	BRIDGE	SQUAD #3
4	290L	-0/5	550	ROAD JCT	CO. "A"
5	1300-2650	—	500-900	ALT SECTOR	18 JAN 89

Fig 4-20. Range card with an FPL.

c. Preparing a range card. To illustrate how you would prepare a range card, we must use our imaginations a little. Observe figure 4-21. It is an illustration of a tactical field setting. Below is a description of the details and lay of the land.

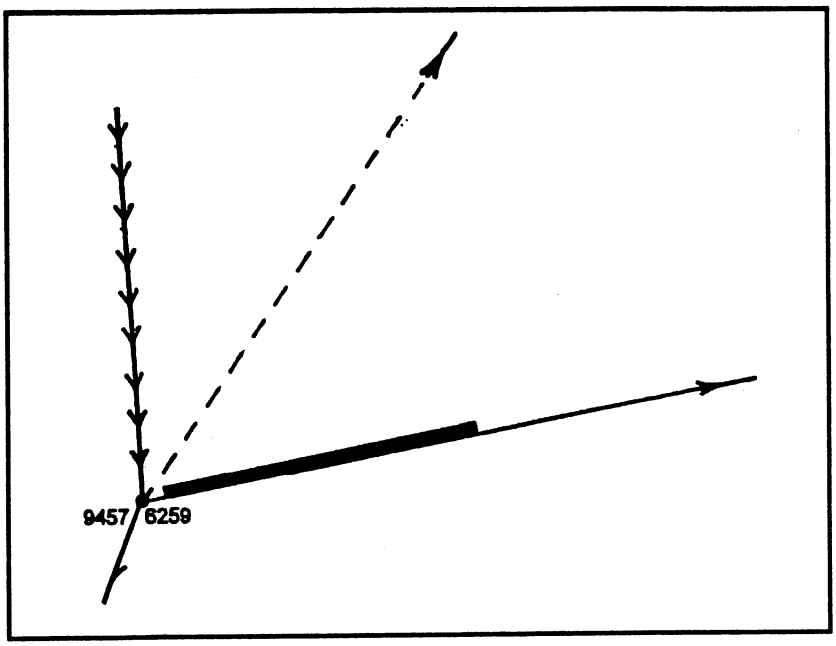


Fig 4-21. Beginning of a range card.

Scenario: Your gun has been attached to Second Platoon, Charlie Company, and your squad leader and his other gun team have been held in general support of the company. The platoon you are attached to is deployed along a low ridge overlooking a narrow valley. The creek bottom across the valley is suspected of being a major infiltration route for the enemy. First Platoon is to Second Platoon's right, and Alpha Company joins Second Platoon on your left. 2nd Lt Bonner, Second Platoon's platoon commander, has told your team leader that he wants your gun set in on the left flank of the platoon. Your team leader has indicated that you are to set in and lay the gun so you can fire FPF across the front of the ridge. The line formed by the base of the ridge is to be your right sector limit, and the trees at the bend in the creek in front of you are to be your left sector limit. The gun team from 3rd Squad that is attached to First Platoon will be firing an FPL back towards your position, and it will interlock with yours. Your team leader has informed you that your gun is located at grid coordinate 94576259, which is also 750 meters from the water tower located on a magnetic back azimuth of 5980 mils. Your FPL lies on a magnetic azimuth of 4250 mils.

Figure 4-22 shows the beginning stages of your range card. The card depicts the weapon symbol, magnetic north arrow, magnetic orientation line, location grid coordinates, sector limits, and grazing fires.

Figure 4-23 shows a completed range card. You have added the unit identification block, terrain features, location of friendly troops or equipment, and targets with their individual data.

If your sketch starts getting cluttered, you may have to use a data block instead of putting target data in the actual sketch. It would look like the data section in figure 4-24.

Fig 4-22. Panoramic view of tactical area.

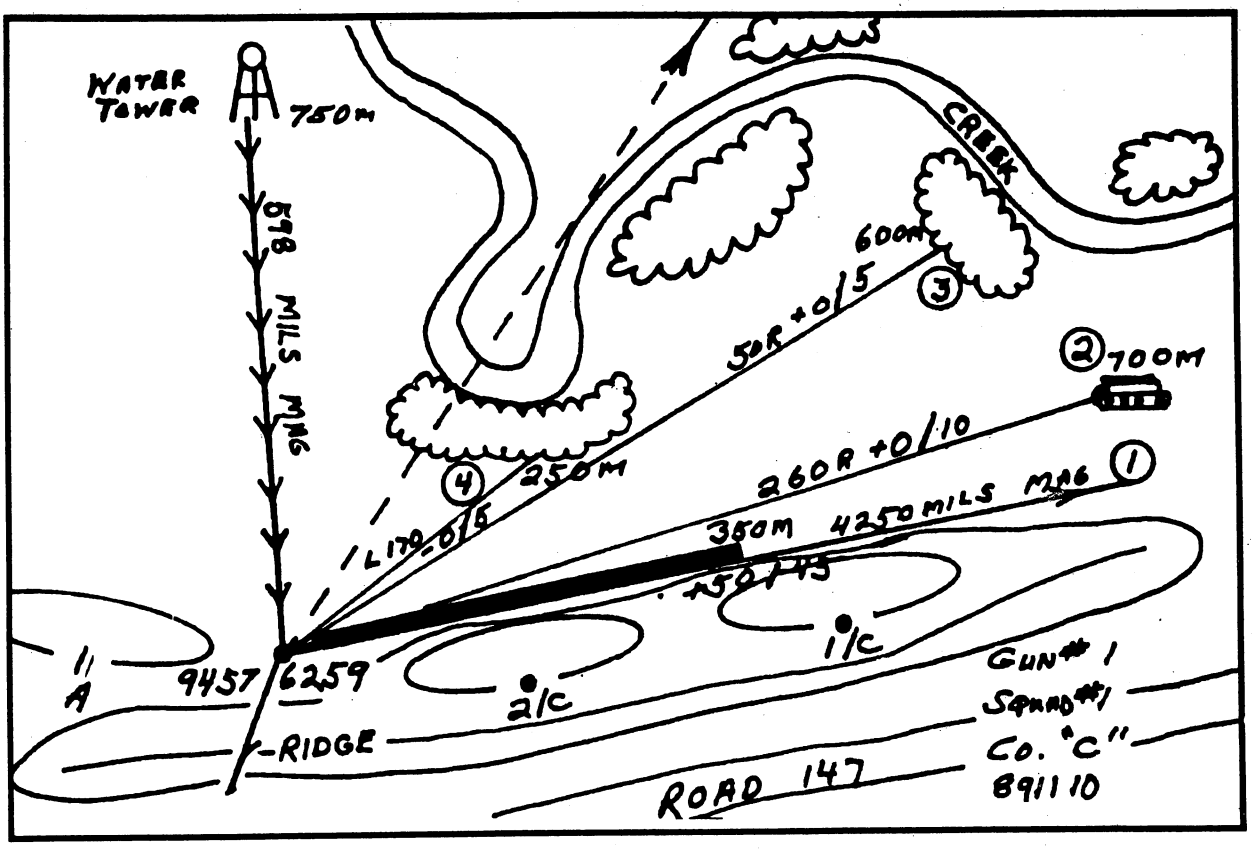
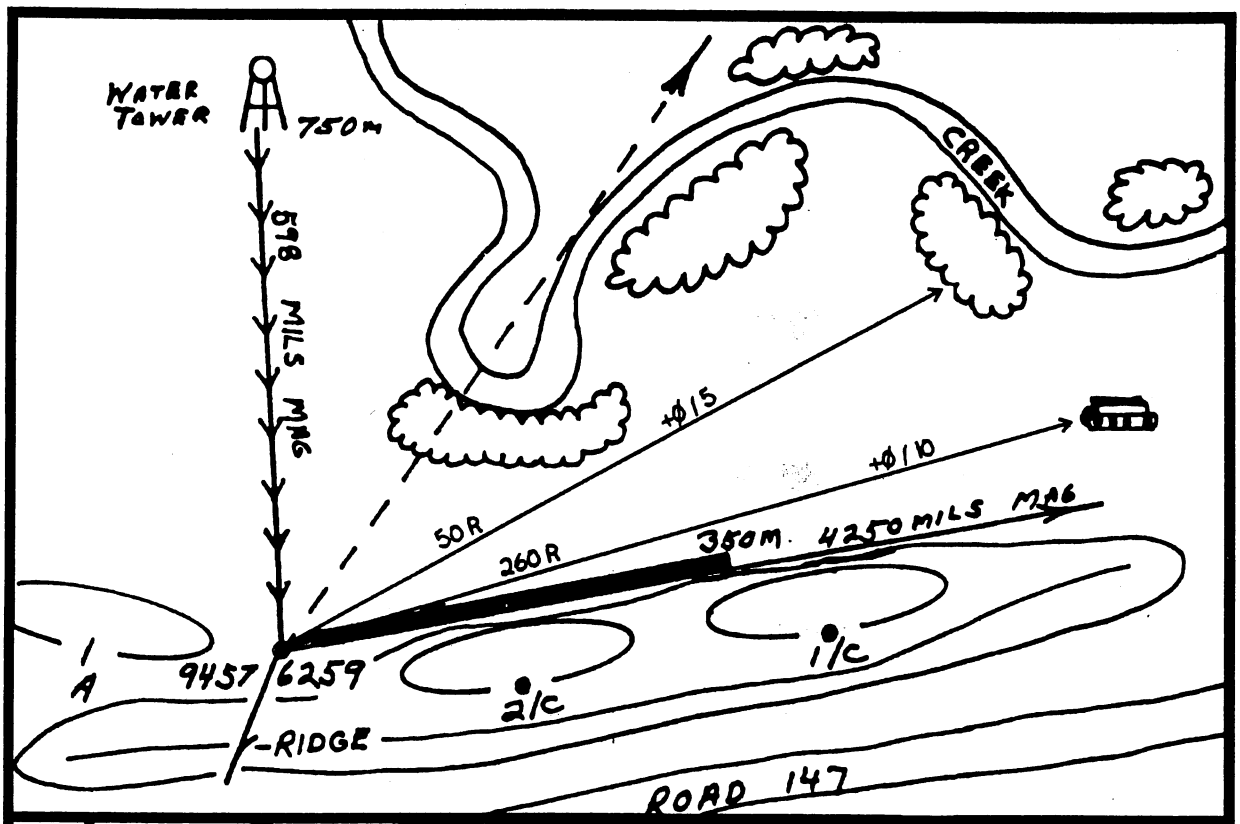


Fig 4-23. Completed range card.



NO	DIRECTION	ELEVATION	RANGE	DESCRIPTION	
1	400 R	+50/45	350	FPL	
2	260R	+0/10	700	DISABLED APC	GUN #1
3	50R	+0/5	600	TREE LINE	SQUAD #1
4	170L	-0/5	250	CREEK BEND	CO. "C"
					891110

Fig 4-24. Range card with separate data section.

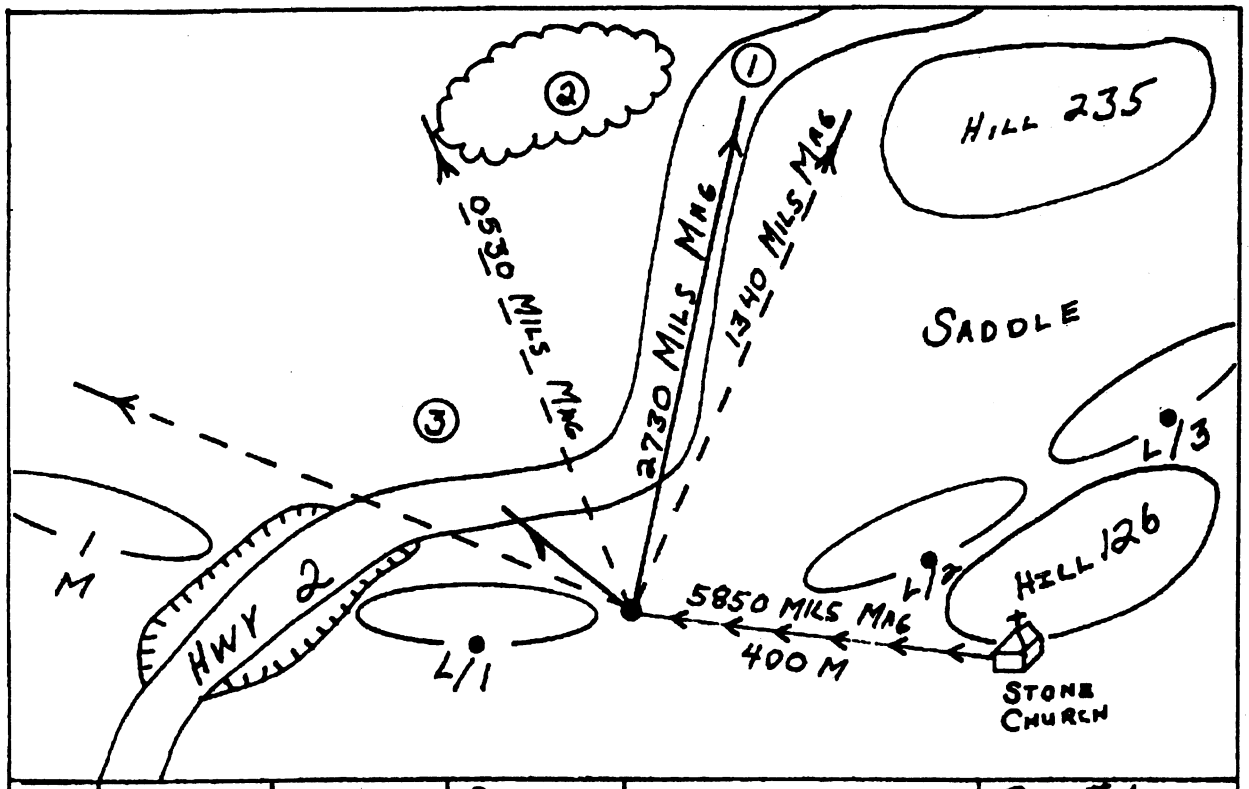
4606. Range Cards and Principle Direction of Fire (PDF)

a. If you have been assigned a PDF instead of an FPL, your range card will be very similar to the ones above. However, regardless of the type of employment you are working with, your range card is always important and will be used the exact same way. The only real difference is in the use of the machinegun symbol. With a PDF, the machinegun symbol will not align with one of the sector limits. On a range card depicting a PDF, you will still use

(1) Gun identification block
(2) Weapon symbol
(3) Magnetic north arrow
(4) Magnetic orientation line and/or location grid
(5) Sector limits
(6) Terrain features

(7) Location of friendly troops or equipment
(8) Targets (when using a PDF, targets are numbered from left to right)

Observe figure 4-25 to see a sample range card for a PDF.



NO	DIRECTION	ELEVATION	RANGE	DESCRIPTION	GUN #1
1	200 R	-50-+50	100-700	ROAD-PLUNGING FIRE	SQUAD #3
2	130 L	-Ø/R5	700	TREE LINE	CO "L"
3	6100-0530	—	—	ALT SECTOR	891207

Fig 4-25. Range card with a PDF.

b. Let's imagine a scenario to illustrate how you would prepare a range card. First, observe figure 4-26 to see an illustration of a tactical field setting. Read the scenario that follows for a description of the details and the lay of the land.

Scenario: Your gun has been attached to 3rd Platoon, A Company, and your squad leader and his other gun team have become casualties. The platoon you are attached to is deployed in a tree line overlooking a bridge. The enemy is suspected to have infiltrated the village on the other side of the river. The mission of the platoon you are attached to is to stop any attempt to cross the river via the bridge. 1st Platoon is to 3rd's right, and B Company joins 3rd on your left. 2nd Lt Jackson, 3rd Platoon's platoon commander, told your team leader he wants your gun set in on the left flank of the platoon and he wants your gun to get the best angle to fire across the bridge. Your team leader indicated you are to set in and lay the gun on a PDF centered on the bridge. The lone tree on your immediate right is your right sector limit. Your team leader informed you that your gun is located at grid coordinate 468262, which is also 350 meters from a road junction located on a magnetic back azimuth of 5420 mils. Your PDF lies on a magnetic azimuth of 4120 mils.

Fig. 4-26. Panoramic view of tactical area.

Figure 4-27 shows the beginning stages of your range card. It depicts the weapon symbol, magnetic north arrow, magnetic orientation line, location grid coordinates, sector limits, and PDF. Why don't you finish it and check your answers with figure 4-28?

Figure 4-28 shows your completed range card. You have added the unit identification block, terrain features, location of friendly troops or equipment, and targets with their individual data.

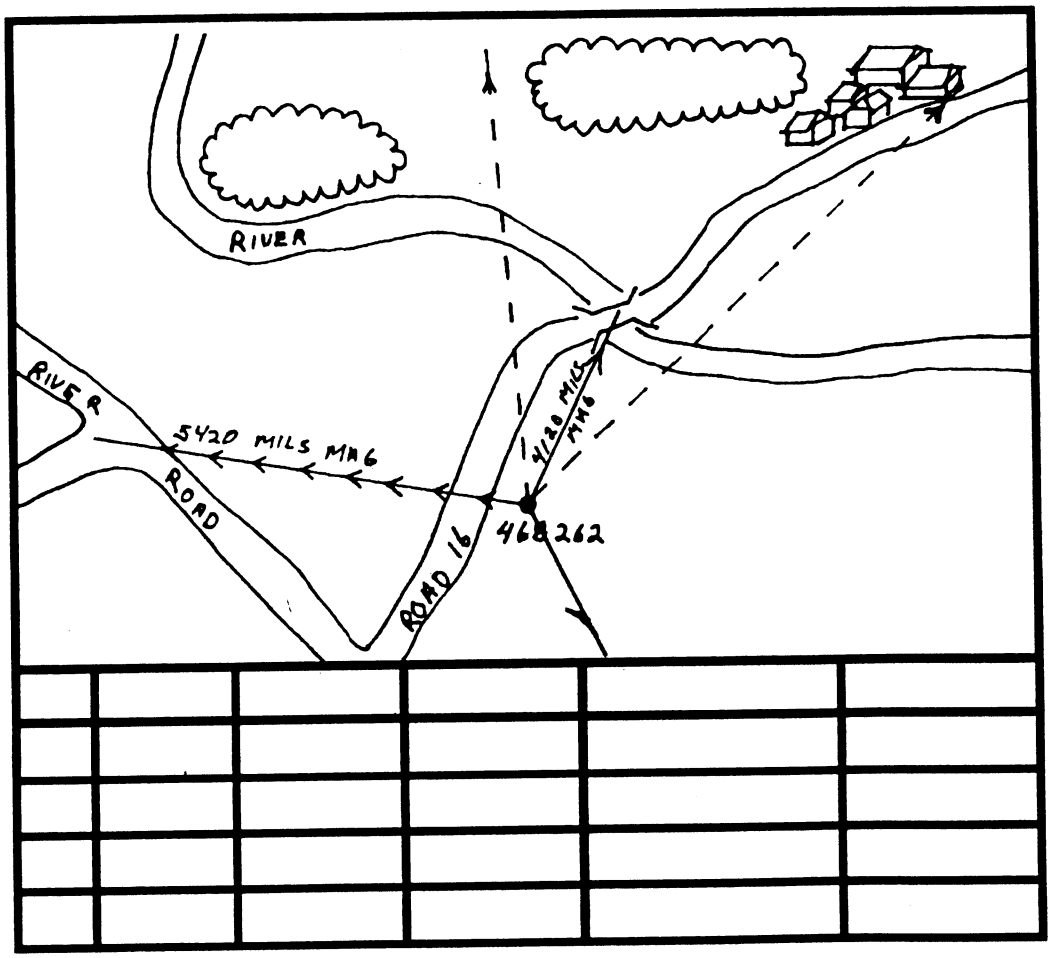
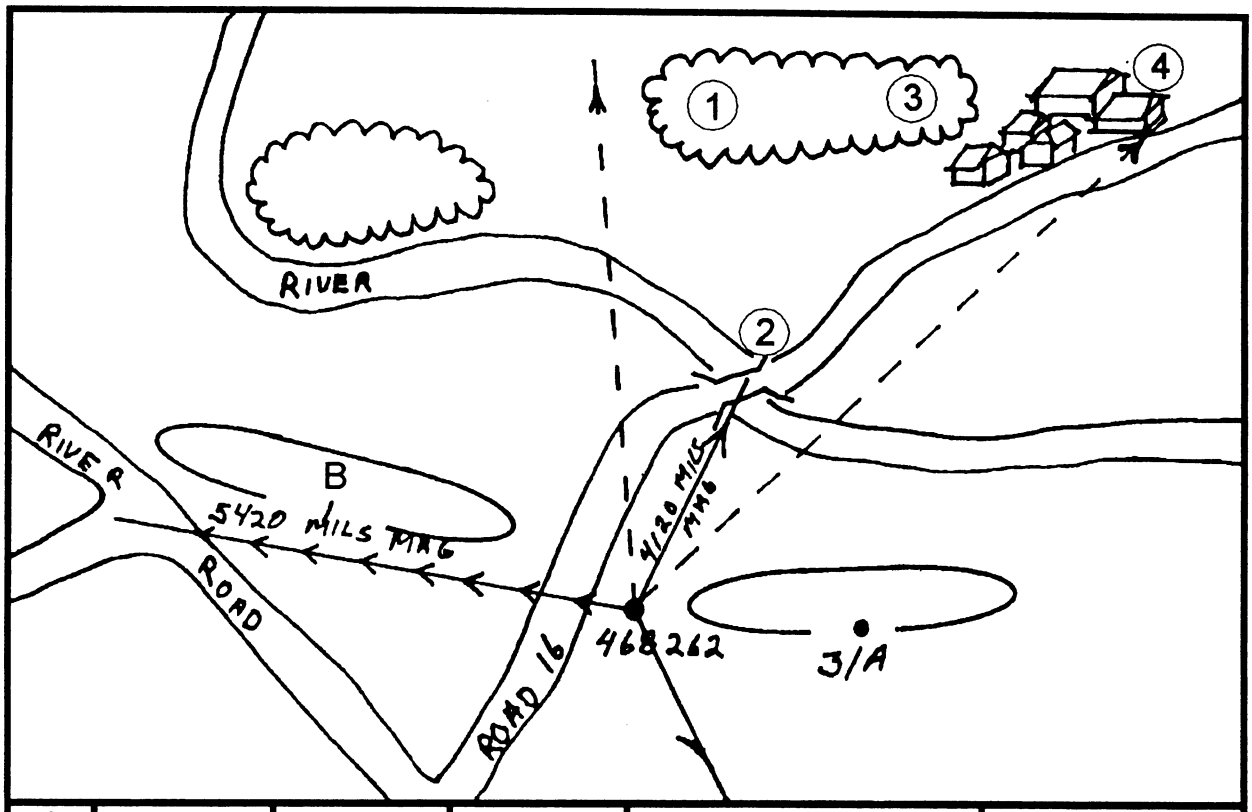


Fig 4-27. Beginning of a range card.



NO	DIRECTION	ELEVATION	RANGE	DESCRIPTION	
1	200L	+50/45	400M	LT EDGE TREELINE	GUN #3
2	40R	+0/25	175M	PDF BRIDGE	SQUAD #2
3	100R	+50/45	450M	RT EDGE TREELINE	CO "A"
4	300R	+100/10	600M	VILLAGE	890704

Fig 4-28. Completed range card.

4607. Field Expedient Methods of Laying for Predetermined Fire

a. Reasons to use field expedient methods. During different tactical situations, you may not be able to use your T&E mechanism for predetermined fire. This may be due to the lack of either a T&E mechanism or a tripod, or you may need a system that is more applicable to firing at night. Whatever the reason, you may want to devise a means of firing predetermined fire without using the T&E mechanism method. The only limits you have are your imagination and available materials. I have listed a few methods with which I am familiar.

b. Base stake method. The base stake method is the simplest and most useful field expedient. Stakes are used to define the sector limits and the FPL. A stake is driven into the ground under the gas cylinder to pick up the elevation needed to fire the FPL (see fig 4-29). Note that the T&E mechanism is still in use. This field expedient in particular will seriously limit the ability to quickly and effectively engage targets outside the sector.

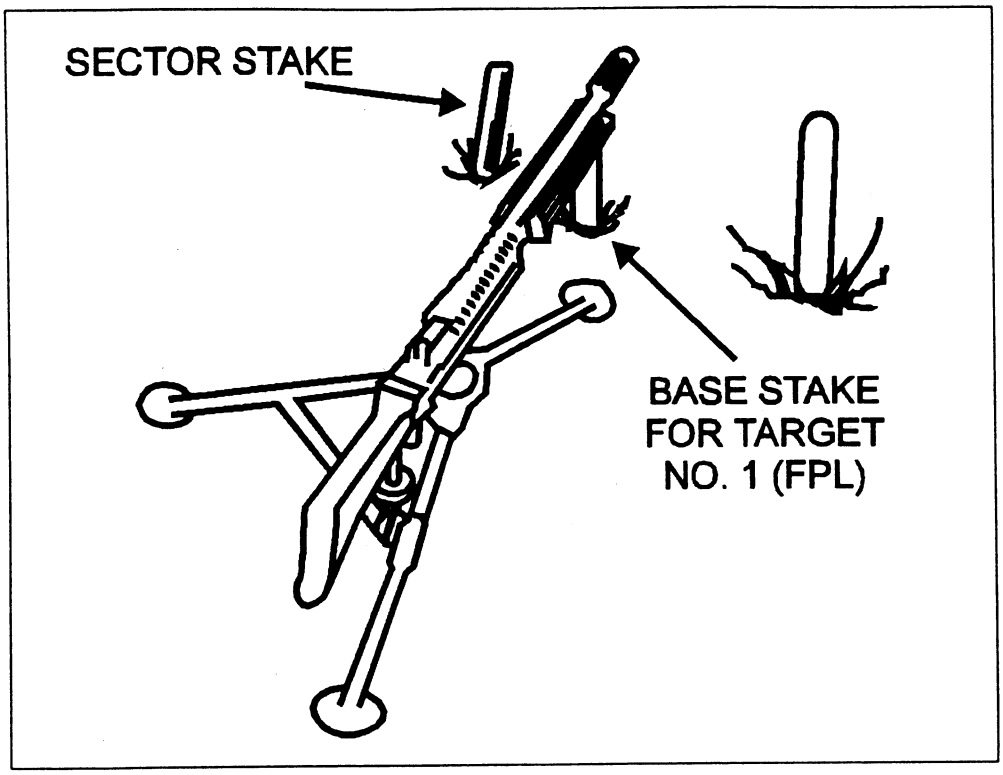


Fig 4-29. Base stake method.

c. Aiming stake method. Luminous tape, luminous paint, or some other suitable material is needed to use this technique. After the gun has been laid to hit the target, follow the steps listed below (see fig 4-30):

(1) Place a strip of luminous tape or paint at least halfway up the rear of the front sight post and on top of a stake.

(2) Raise the rear sight slide to its uppermost position.

(3) Move the head slightly to the right so the front sight post appears in the left corner of the rectangle formed by the rear sight slide and the rear sight lead. Maintaining the same positions and grip, direct the assistant gunner to drive the stake into the ground about 1 meter in front of the gun. Align the stake so the two pieces of luminous material are adjacent (aligned for direction) and the top edges of both pieces of material are level (aligned for elevation). Set out one stake is for each target.

(4) To hit a target when it cannot be seen, raise the rear sight slide to its uppermost position and manipulate the gun until the correct sight picture is obtained by aligning the luminous tape.

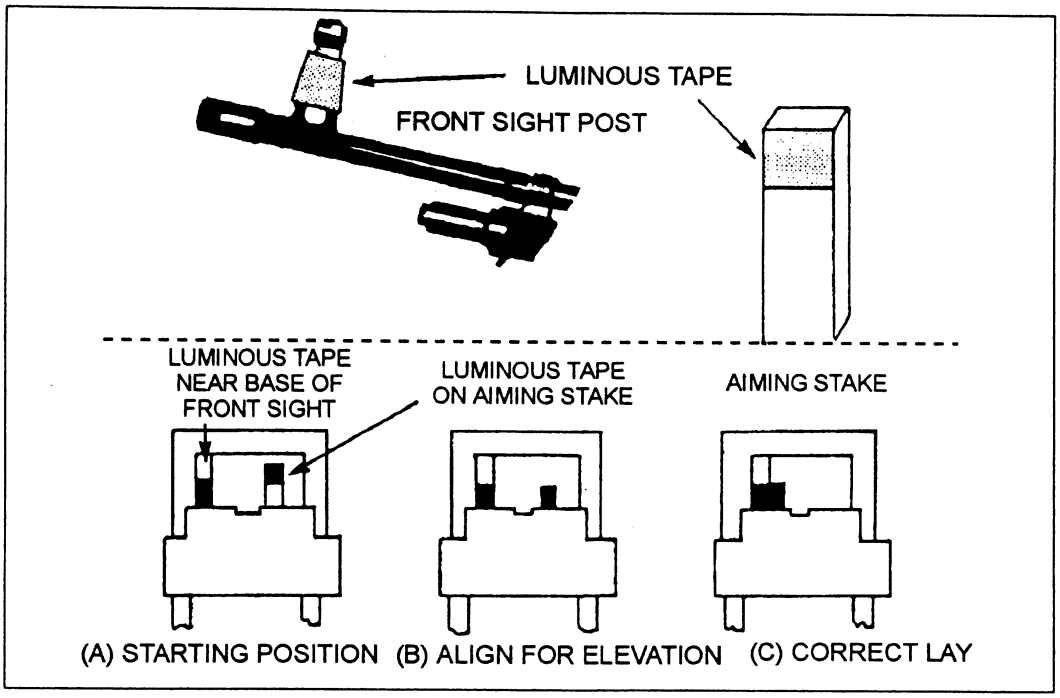


Fig 4-30. Aiming stake method.

d. Horizontal log method. This technique is used to define sector limits and fields of grazing fire. The FPL would be located along one of the sector stakes. A log or board is placed between the sector stakes in such a way that the barrel will be at the proper elevation to obtain grazing fire across the front. In this case, the tripod is used, but not the T&E mechanism (see fig 4-31).

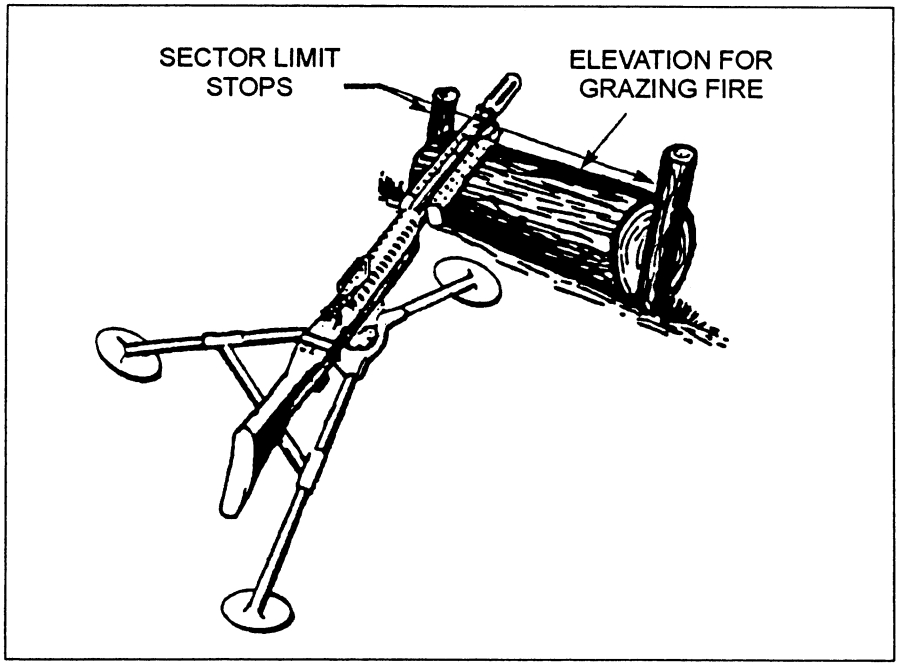


Fig 4-31. Horizontal log method

e. Notched stake method. If, for some reason, the bipod mount is being used instead of the tripod, targets can be made predetermined by the use of notched or forked stakes. The stakes are driven into the ground so the butt stock rests in the notches when the gun is laid to hit the target. Shallow trenches or grooves are dug for the bipod feet (see fig 4-32).

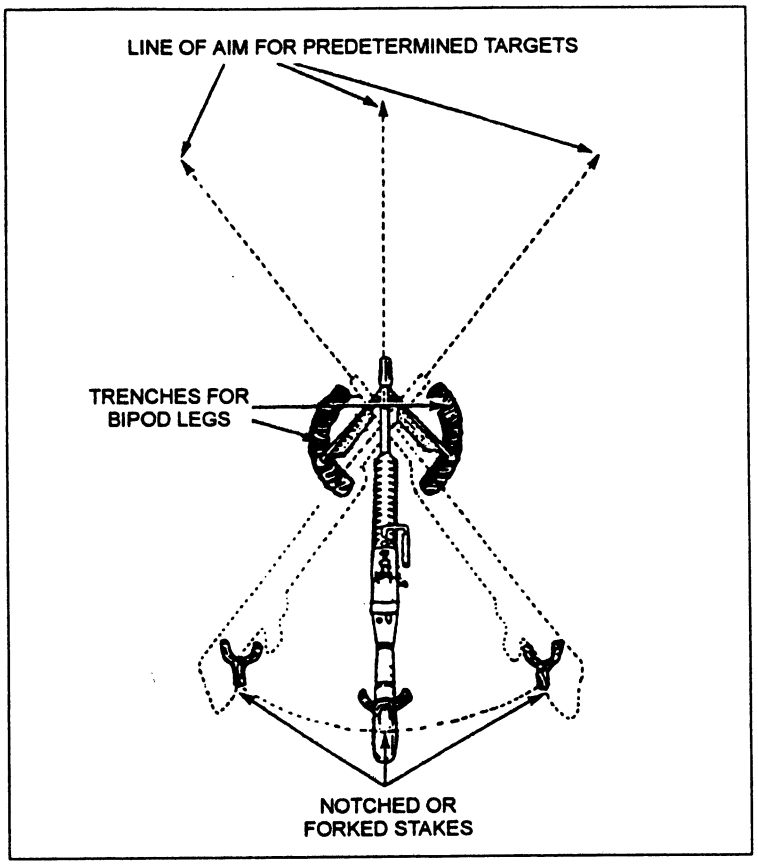


Fig 4-32. Notched staked method.

f. Auxiliary aiming point method. When the target is not visible to the gunner or is exceptionally difficult to see, fire may often be directed by the use of an auxiliary aiming point, securing data by one of the two methods given below. The M240G may be laid by using an auxiliary aiming point that is not more than 10 mils off the gun target line.

(1) Binocular method. The team leader selects a clearly defined object in the vicinity of the target (see fig 4-33). Using the inverted leaf sight, he aligns on the target the graduation that corresponds with the range to the target (1050). Keeping the binocular in that position, he reads the graduation on the scale opposite the auxiliary aiming point. When the auxiliary aiming point is not on the gun target line, the deflection is read on the horizontal mil scale of the binocular. Using these readings as the sight setting and deflection (for example, range 1,350, sight right 20), the gunner lays on the object selected as the auxiliary aiming point and fires, distributing the fire as ordered by the team leader.

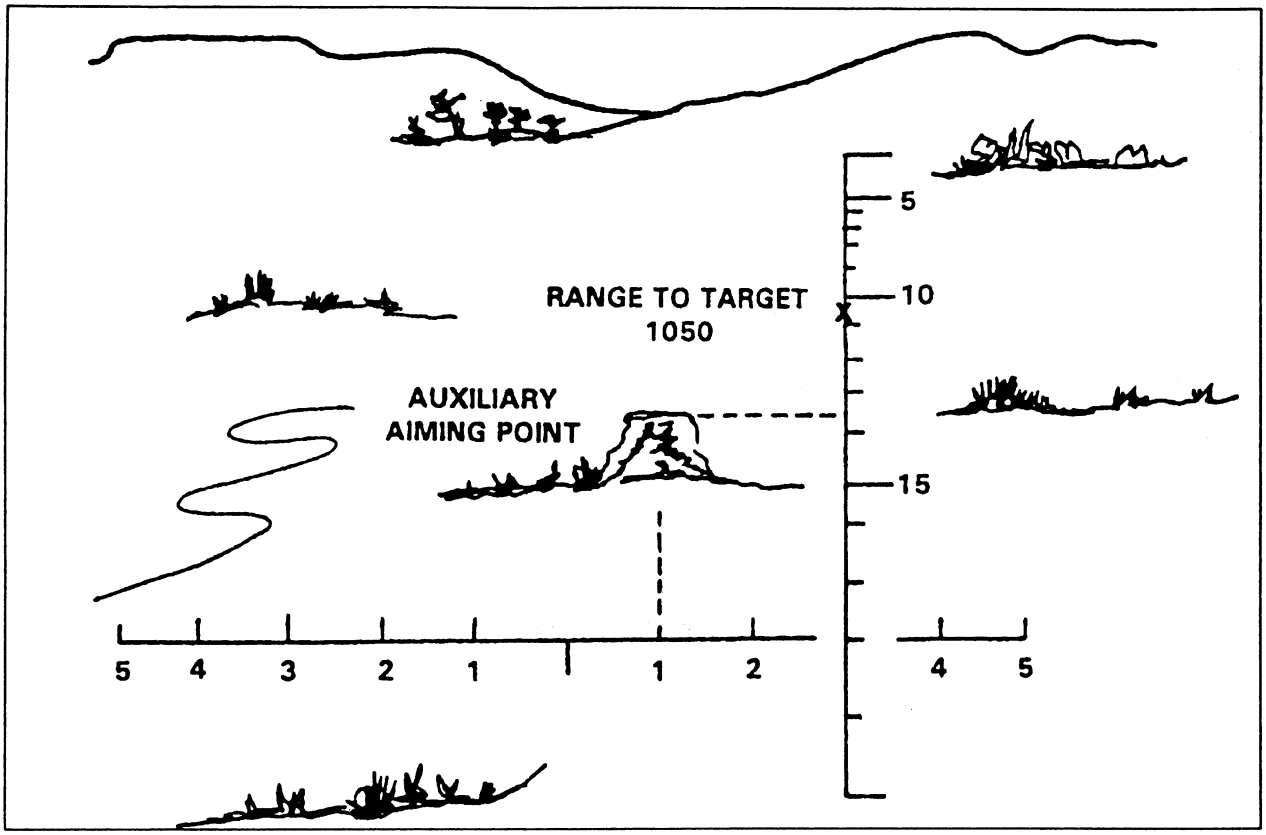


Fig 4-33. Binocular method.

(2) Gun method. Data for auxiliary aiming points may be determined by means of the rear sight slide and windage scale on the gun. The gun is first laid on the target with the correct sight setting to hit the target, and when the tactical situation permits, the initial lay is verified by firing. Then, without disturbing the lay of the gun, the rear sight is manipulated so that the line of aim is directed at some clearly defined object (stump, bush, or aiming stake) that the gunner is always able to see, no matter what the visibility conditions may be. The settings on the rear sight and windage gauge are recorded. Then, when fire is to be placed on the target, the team leader announces these settings in his fire command and orders the gunner to lay on the auxiliary aiming point. An example of a fire command is provided below:

"Fire Mission"
"Direct Front"
"Auxiliary Aiming Point"
"Black Stump"
"1,350 Sight"
"Right 20"
"Fixed"
"At My Command"
"FIRE"

Lesson Summary. You covered a lot in this lesson, including selecting methods of emplacement; reading elevations and directions with a T&E mechanism; constructing range cards; and using field expedient methods for laying machineguns for predetermined fire.

Next is the unit exercise. Are you ready? Or do you feel you should go back and review the highlights of each lesson before taking this exam? Remember, review is valuable. This is a practice for the real thing! Good luck!

Study Unit 4 Exercise: Complete items 1 through 21 by performing the action required. Check your responses against those listed at the end of this study unit.

1. Identify the fire used to engage wide targets.

   a. Elevating
   b. Deflecting
   c. Traversing
   d. Searching

2. Identify the fire used to engage deep targets.

   a. Elevating
   b. Deflecting
   c. Traversing
   d. Searching

3. Identify the fire used to engage oblique targets.

   a. Elevating traverse
   b. Deflecting elevation
   c. Diagonal traverse
   d. Searching traverse

4. Identify which list has the three options used to engage widely dispersed targets.

   a. Elevating traverse
Point target
Swinging traverse
   b. Swinging traverse
Point target
Free gun
   c. Diagonal traverse
Point target
Swinging traverse
   d. Free gun
Point target
Elevation traverse

5. The key to using the tracking method of engaging moving targets is maintaining a

a. constant bead on a target.
b. constant lead on a target.
c. constant zero on a target.
d. varying lead on a target.

6. Identify the key to using the trapping method of engaging moving targets.

a. Estimating the lead required and following an aiming point wherever the target goes.
b. Estimating the lead required and holding an aiming point until the target is at the correct position.
c. Estimating the level required and holding an aiming point slightly higher than the target.
d. Estimating the lead required and holding a two finger aiming point in front of the target.

7. Identify the rate of fire used to engage aerial targets.

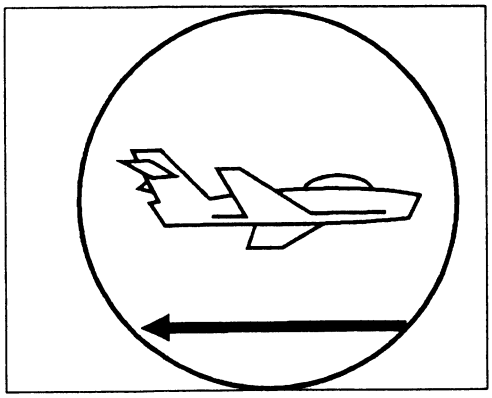
a. Slow
b. Sustained
c. Rapid
d. Cyclic

Matching: For items 8 through 11, match each illustration of a tracer path that missed in group 1 with the correct lead adjustment from group 2.

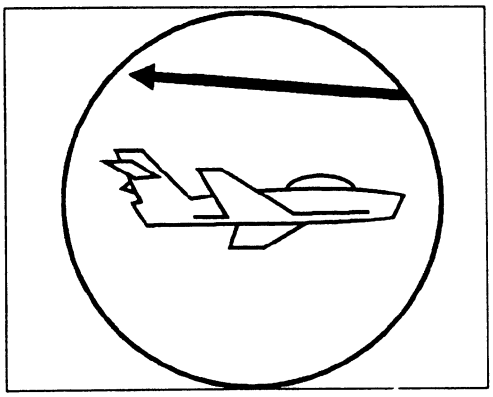
Group 1

Paths of Tracers That Missed

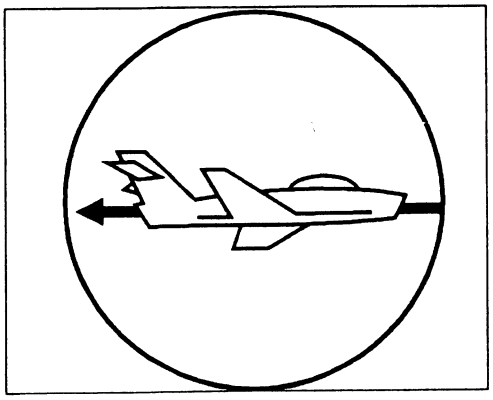
8.



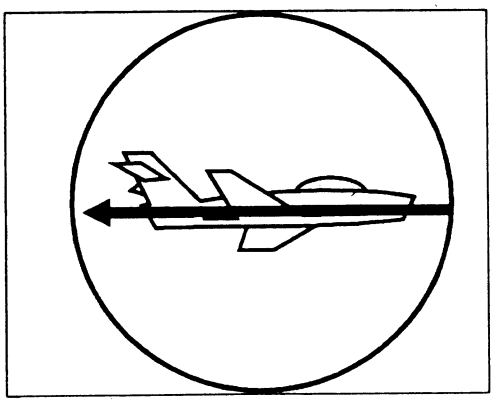
9.



10.



11.



Group 1

Paths of Tracers That Missed

___ 8. (See figure above.)
___ 9. (See figure above.)
___ 10. (See figure above.)
___ 11. (See figure above.)

Group 2

Correct Lead Adjustment

a. Lower your aim.
b. Raise your aim.
c. Reduce your lead.
d. Increase your lead.

12. Identify three methods of establishing initial direction of fire used to engage targets from positions defilade.

    a. Reference point, compass azimuth, and indirect lay/direct alignment
    b. Refraction point, compass bezel, and indirect lay/direct alignment
    c. Relief point, compass azimuth, and direct lay/indirect alignment
    d. Reference point, compass plot, and direct lay/indirect alignment

13. State in writing the defintion of initial direction of lay.

---

14. Identify the safety precautions to use when firing overhead friendly troops.

    a. Refer to MCO P3570.1A.
    Don't fire through trees and brush.

    b. Refer to MCO P1020.
    Don't fire through trees and brush.

    c. Refer to MCO P3570.1A.
    Fire through trees and brush.

    d. Refer to MCO P1020.
    Fire through trees and brush.

15. Identify the item that could best be used as a muzzle or depression stop to avoid having a muzzle depressed too low during overhead firing.

    a. Rocks and masonary
    b. Large diameter logs
    c. Dirt piles
    d. Strands of wire

16. Which list contains the correct information needed to lay the M240G for Final Protective Line (FPL).

a. Physical location
Right lateral limits
Which sector limit contains the FPL
Squads or guns located on your left and right
Dead space

b. Physical location
Left and right lateral limits
Which sector limit contains the FPL
Squads or guns located in your rear area
Dead space

c. Physical location
Left and right lateral limits
Which sector limit contains the FPL
Squads or guns located on your left and right
Dead space

d. Physical location
Left and right lateral limits
Which sector limit contains the PDL
Squads or guns located on your left flank
Dead space

17. Which list contains the correct information needed to lay the M240G for Principle Direction of Fire (PDF).

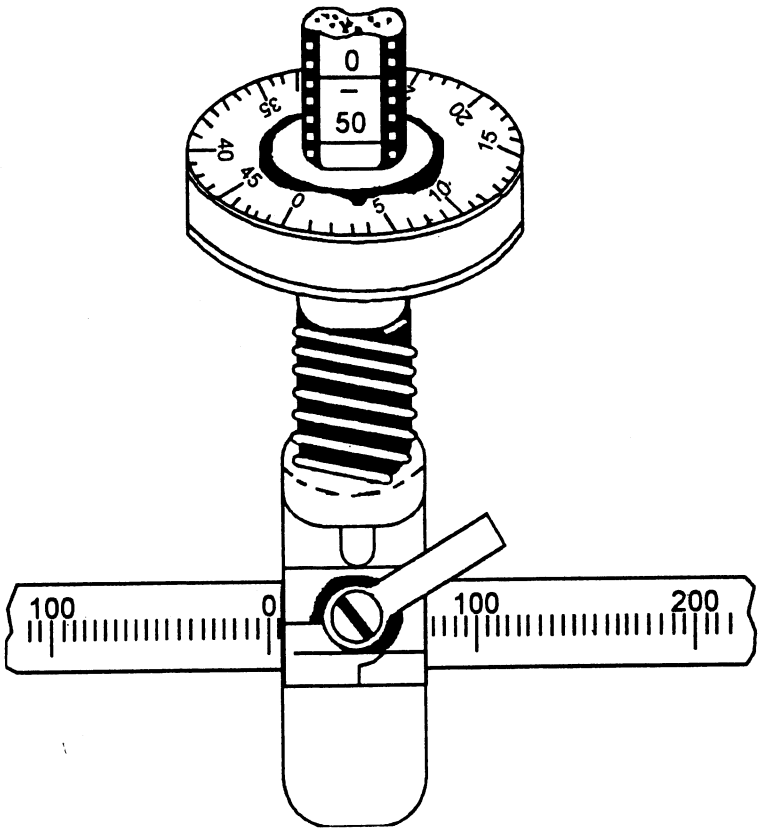
a. Squads or guns located on your right
Dead Space
What is to be used as the PDF
Location of alternate and supplementary positions

b. Squads or guns located on your left only
Dead Space
What is to be used as the FPL
Location of alternate and supplementary positions

c. Squads or guns located on your left and right
Dead Space
What is to be used as the PDF
Location of alternate and supplementary positions

d. Squads or guns located on your left and right
Beaten Zone
What is to be used as the PDF
Location of alternate and supplementary positions

18. From the illustrations of a T&E mechanism, read the correct elevation and direction readings.



a. R5 - 50/3
b. R10 - 100/3
c. L5 - 50/3
d. L10 - 100/3

19. Identify the correct list of components used on a range card.

a. Gun identification block
Weapon symbol
Magnetic south arrow
Targets

b. Gun identification block
Weapon Symbol
Magnetic north arrow
Targets

c. Gun identification block
Weapon symbol
Magnetic east/west arrow
Targets

d. Gun identification block
Weapon symbol
Magnetic south arrow
Enemy troops only

20. From the description of a defensive position below and the illustration on the next page, construct a range card that includes a principle direction of fire.

Scenario: Your gun has been attached to First Platoon, Charlie Company and your squad leader and his other gun team have been held in general support of the company. The platoon you are attached to is deployed along one side of a long narrow open area in a thickly timbered area. The road that runs through the open area is suspected of being a major resupply route for the enemy. Second Platoon is to First's right and A Company joins First on your left. 2ndLt O'Connor, First Platoon's platoon commander, told your team leader he wants your gun set in on the left flank of the platoon. Your team leader indicated you are to set in and lay the gun on the PDF. The PDF will fire down the center of the road. The line formed by the near side of the open area is to be your right sector limit and a chimmey at your left front is to be your left sector limit. The gun team from 3rd Squad that is attached to Second Platoon will be firing an FPL back towards your position. Your team leader has informed you that your gun is located at grid coordinates 94576259, which is also 750 meters from the water tower located on a magnetic back azimuth of 5980 mils. Your PDF lies on a magnetic azimuth of 4125 mils.

21. Identify three acceptable field expedient methods of laying a machinegun for predetermined fire.

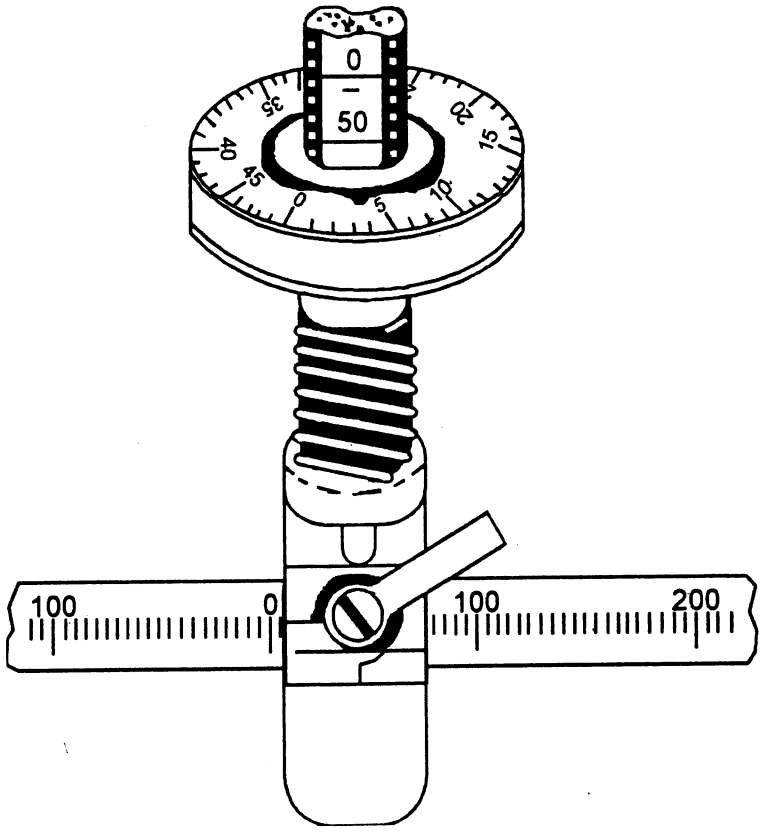
a. Muzzle stake
Notched log under muzzle
Forked stakes

b. Notched log under receiver
Aiming tape
Muzzle stakes

c. Base stake
Aiming stake
Notched stake

d. Aiming stakes and tape
Forked stakes
Notched log under muzzle

18. From the illustrations of a T&E mechanism, read the correct elevation and direction readings.



a. R5 - 50/3
b. R10 - 100/3
c. L5 - 50/3
d. L10 - 100/3

19. Identify the correct list of components used on a range card.

a. Gun identification block
Weapon symbol
Magnetic south arrow
Targets

b. Gun identification block
Weapon Symbol
Magnetic north arrow
Targets

c. Gun identification block
Weapon symbol
Magnetic east/west arrow
Targets

d. Gun identification block
Weapon symbol
Magnetic south arrow
Enemy troops only

20. From the description of a defensive position below and the illustration on the next page, construct a range card that includes a principle direction of fire.

Scenario: Your gun has been attached to First Platoon, Charlie Company and your squad leader and his other gun team have been held in general support of the company. The platoon you are attached to is deployed along one side of a long narrow open area in a thickly timbered area. The road that runs through the open area is suspected of being a major resupply route for the enemy. Second Platoon is to First's right and A Company joins First on your left. 2ndLt O'Connor, First Platoon's platoon commander, told your team leader he wants your gun set in on the left flank of the platoon. Your team leader indicated you are to set in and lay the gun on the PDF. The PDF will fire down the center of the road. The line formed by the near side of the open area is to be your right sector limit and a chimmey at your left front is to be your left sector limit. The gun team from 3rd Squad that is attached to Second Platoon will be firing an FPL back towards your position. Your team leader has informed you that your gun is located at grid coordinates 94576259, which is also 750 meters from the water tower located on a magnetic back azimuth of 5980 mils. Your PDF lies on a magnetic azimuth of 4125 mils.

21. Identify three acceptable field expedient methods of laying a machinegun for predetermined fire.

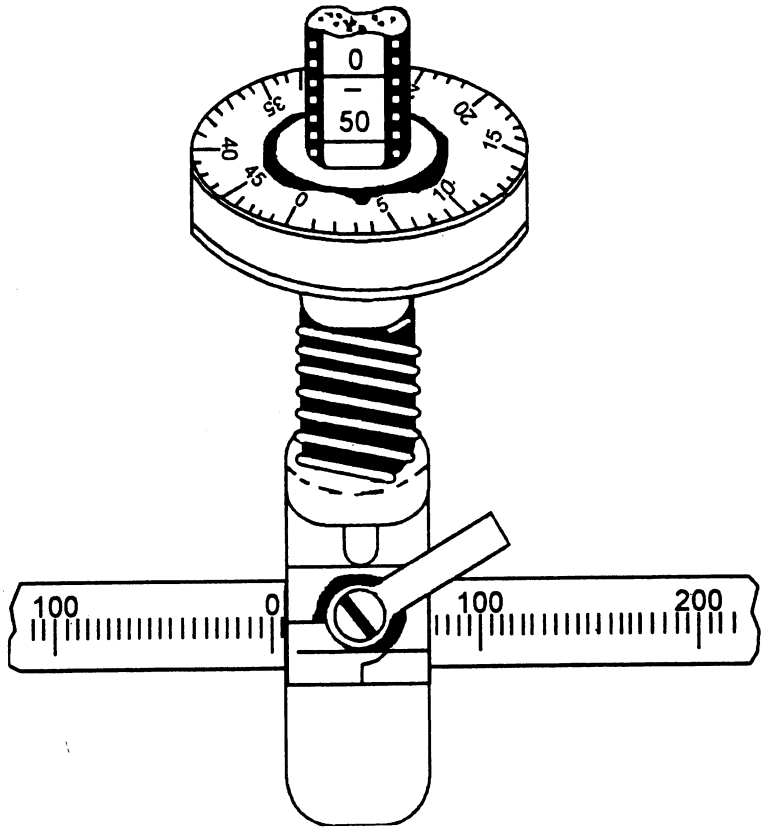
a. Muzzle stake
Notched log under muzzle
Forked stakes

b. Notched log under receiver
Aiming tape
Muzzle stakes

c. Base stake
Aiming stake
Notched stake

d. Aiming stakes and tape
Forked stakes
Notched log under muzzle

18. From the illustrations of a T&E mechanism, read the correct elevation and direction readings.



a. R5 - 50/3
b. R10 - 100/3
c. L5 - 50/3
d. L10 - 100/3

19. Identify the correct list of components used on a range card.

a. Gun identification block
Weapon symbol
Magnetic south arrow
Targets

b. Gun identification block
Weapon Symbol
Magnetic north arrow
Targets

c. Gun identification block
Weapon symbol
Magnetic east/west arrow
Targets

d. Gun identification block
Weapon symbol
Magnetic south arrow
Enemy troops only

20. From the description of a defensive position below and the illustration on the next page, construct a range card that includes a principle direction of fire.

Scenario: Your gun has been attached to First Platoon, Charlie Company and your squad leader and his other gun team have been held in general support of the company. The platoon you are attached to is deployed along one side of a long narrow open area in a thickly timbered area. The road that runs through the open area is suspected of being a major resupply route for the enemy. Second Platoon is to First's right and A Company joins First on your left. 2ndLt O'Connor, First Platoon's platoon commander, told your team leader he wants your gun set in on the left flank of the platoon. Your team leader indicated you are to set in and lay the gun on the PDF. The PDF will fire down the center of the road. The line formed by the near side of the open area is to be your right sector limit and a chimmey at your left front is to be your left sector limit. The gun team from 3rd Squad that is attached to Second Platoon will be firing an FPL back towards your position. Your team leader has informed you that your gun is located at grid coordinates 94576259, which is also 750 meters from the water tower located on a magnetic back azimuth of 5980 mils. Your PDF lies on a magnetic azimuth of 4125 mils.

21. Identify three acceptable field expedient methods of laying a machinegun for predetermined fire.

a. Muzzle stake
Notched log under muzzle
Forked stakes

b. Notched log under receiver
Aiming tape
Muzzle stakes

c. Base stake
Aiming stake
Notched stake

d. Aiming stakes and tape
Forked stakes
Notched log under muzzle

Illustration for question 20.

UNIT SUMMARY

In this study unit you learned how to engage personnel, stationary, moving, and aerial targets. You also learned how to engage targets by indirect fire, how to engage predetermined targets, and the procedures for firing overhead of friendly troops. In the next study unit you will learn how to employ and qualify the M240G.

Study Unit 4 Exercise Solutions		Reference
1.	c.	4101
2.	d.	4102
3.	d.	4103
4.	d.	4104
5.	b.	4203
6.	b.	4204
7.	c.	4302
8.	b.	4303
9.	c.	4303
10.	a.	4303
11.	d.	4303
12.	The direction you lay the gun when it is aimed to start a mission	4402
13.	a.	4402
14.	a.	4502
15.	b.	4503
16.	c.	4602
17.	c.	4603
18.	c.	4604
19.	b.	4605
20.	Self-evaluation; refer to references	4605, 4606
21.	c.	4607

STUDY UNIT 5

MACHINEGUN EMPLOYMENT

Introduction. During the planning stages of offensive and defensive combat, you will have to decide where to place the machinegun(s). Your plan must be sound if you are to accomplish the mission. Often machineguns are just placed into position without much thought! Remember, your mission is to provide continuous accurate fire on the enemy.

Lesson 1. UNDERSTANDING THE GENERAL PRINCIPLES

LEARNING OBJECTIVES

1. Identify the eight principles of machinegun employment.
2. Match the principles of machinegun employment with their effects.
3. Identify the steps for establishing a machinegun base of fire.
4. Identify the two manual ways to destroy the M240G.
5. Identify the steps for destroying ammunition for the M240G.

5101. Principles of Machinegun Employment

a. Application. As a machinegunner, your goal is to employ your machinegun with maximum efficiency. To help you achieve this goal, the eight principles of machinegun employment are listed below. Although these principles have been proven to be sound in combat, they are not presented here as gospel. A great deal depends on your judgment as a professional. For example, even though these principles are prioritized, the tactical situation may require you to use them simultaneously.

b. Eight principles. During the planning stage of machinegun employment, use the following eight principles:

(1) Mutual support. Because of the devastation they inflict, machineguns often become the enemy's chief target. Therefore, machineguns should be able to provide fire support to protect one another. In addition, the infantry unit should provide security for the guns.

(2) Employed in pairs. One machinegun alone cannot provide continuous fire for a long period, nor can it engage multiple targets simultaneously. However, machineguns employed in pairs are able to provide continuous fire and engage multiple targets. While one machinegun reloads, the other continues to fire.

(c) Coordination of fire. Coordinate your machinegun fire with the fires of other machineguns and weapons. Look for dead space along the FPL, making sure you hit the enemy before he gets to cover. In the offense, the unit leader must coordinate with friendly units to ensure all phases laid out in the five-paragraph order (preparation firing, final assault, consolidation, and pursue by fire) are understood by all and everyone is on the same sheet of music.

(d) Positioned in defilade. Position the machinegun in the defilade when possible. This makes it difficult for the enemy to place effective fire on your position.

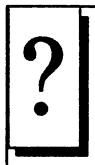
(e) Position to produce enfilade fire. Enfilade fire is the most effective fire to engage targets.

(f) Interlocking fire. Interlocking fire provides the wall of steel in front of your position. Ensure the fire covers the obstacles between you and the enemy.

(g) Cover and concealment. Construct each machinegun position to provide cover and concealment.

(h) Economy. A machinegun has a very high rate of fire that can consume ammunition quickly. To conserve ammunition, employ machineguns in pairs. When one gun is about to stop firing, the other gun can start engaging targets. The result is effective and continuous fire. This technique is called "talking guns." Remember, the mission may require you to suppress the enemy for a long period of time. Therefore, you must plan ahead to avoid running out of ammo.

These eight principles are a solid starting point for machinegun employment. Use them whenever possible.



Do you remember why machineguns are employed in pairs?

Answer: "So they can provide continuous fire and engage multiple targets"? Did you know the answer? Excellent!

♦♦♦

Why do we position the machinegun in the defilade?

Answer: "For protection--to make it difficult for the enemy to place effective fire upon your position." Were you correct? Great!

5102. Establish a Machinegun Base of Fire

a. General. During offensive operations you will need to establish a base of fire to support the attack. The employment of the machineguns is crucial to the success of the unit. It is imperative that you use the eight principles of machinegun employment while planning the base of fire. Remember, the attacking unit will be vulnerable to the enemy's fire. Never take the establishment of a base of fire lightly! The location of the base of fire, as well as the coordinating instructions to start, cease, shift fire, and displace, will be given during the five-paragraph order. Listed below are the steps to establish a base of fire:

b. Apply eight principles. It is imperative that you apply the eight principles of machinegun employment while planning the base of fire. The steps to establish a base of fire are listed below:

Note: Always maintain communications with the maneuver element.

(1) Select firing position. Engage targets from a defilade position if possible.

(2) Determine the range to target(s).

(3) Lay the gun on target.

(4) Determine safety limits for overhead fire, if required.

(5) Respond to the fire commands (open, shift, and cease).

(6) Adjust fires (as required).

(7) Displace on one order.

(8) Be prepared to assist in the consolidation of objectives by firing to protect against a counterattack.

5103. Destruction of the M240G Machinegun, Equipment, and Ammunition

a. General. History has shown us that sometimes situations arise in combat that require us to destroy our equipment so the enemy cannot use it. The destruction of equipment must be authorized by the commanding officer or his representative.

b. Means of destruction. Listed below are several ways to destroy or render useless a machinegun and its equipment.

(1) Manually destroy the M240G.

(a) Mechanical

1. Smash the weapon with a sledge hammer, metal pipe, large rocks, machinegun barrel, tripod, or with anything available.

2. Run over the weapon with a tracked-vehicle or heavy vehicle.

3. Remove and/or destroy critical gun parts. If you are destroying multiple weapons, remove like parts so weapons cannot be pieced together to make one or more complete gun(s).)

(b) Burning

Note: Use a fuel hot enough to remove the temper from the metal (such as JP-4).

(2) Use demolition or munitions to destroy the M240G.

(a) Place high explosives so they completely destroy all weapons.

(b) Pile weapons. Destroy with machinegun, rifle, grenade, or artillery fire. Scatter remaining parts.

(c) Place an incendiary grenade on the receiver group over the bolt. Have the cover resting on the grenade.

(3) Dispose of the critical parts of the M240G.

(a) Scatter critical parts of the weapons in swamps, marshes, mud, etc., so the enemy will not find them.

(b) Bury critical parts so the enemy cannot find them.

c. Priority of destruction. Destroy the weapons and equipment in the following order of priority:

(1) Bolt

(2) Operating rod

(3) Barrels

(4) Sights

(5) T&E mechanism

d. Ammunition. Destroy M240G ammunition by using one of the means listed below:

(1) Fire the ammunition if time permits.

(2) Bury or dump the ammunition in a lake, river, swamp, or marsh.

(3) Explosives. Place explosive to ensure complete destruction of all ammunition.

Warnings: **NEVER** scatter ammunition; it may become a hazard to friendly troops.

NEVER burn ammunition; it will explode and launch in all directions.

NEVER use mechanical means to destroy ammunition.

Lesson Summary. This lesson covered the principles and characteristics of machinegun employment and the elements in the five-paragraph order pertaining to employing the machinegun. This lesson also covered how to destroy a machinegun, its equipment, and the ammunition. The next lesson discusses machinegun positions.

Lesson 2. LEARNING ABOUT MACHINEGUN POSITIONS

LEARNING OBJECTIVES

1. Select in sequence the priority of work.
2. Select the four types of preplanned machinegun positions
3. Identify when you would use a hasty position.

Defensive operations is a key part of combat operations and requires an enormous amount of planning. To be properly prepared for the enemy assault, you must have a superior fire plan. Before attacking, the enemy will attempt to soften your defense with mortar, artillery, and direct fire. With a well-prepared machinegun position you can limit the amount of damage the enemy inflicts on you, making it easier to repel and destroy the enemy.

There are four types of machinegun fighting positions:

- T-shaped
- L-shaped
- Horseshoe-shaped
- Two-hole

The following material will provide you the priority of work, the dimensions, and the characteristics of each machinegun fighting position.

5201. Priority of Work

The priority of work remains the same regardless of the fighting position you construct. Once you have received your sector of fire, follow these steps:

Note: Think "SAFE."

S Establish Security.

A Assign Automatic weapons.

F Clear fields of Fire.

- Start from your position and work forward.
- Thin the tree limbs and other objects that could provide cover to the enemy.

Note: Never clear the fields of fire in a manner that will give away your position.

E Entrench.

- Construct overhead cover.

5202. Preplanned Positions

a. T-shaped position. The T-shaped is the preferred machinegun fighting position. Its advantages are that you have the ability to fire the primary and alternate sectors of fire, and it provides cover to the front. The primary sector of fire should be placed to the oblique so the gun can fire lengthwise across the unit's front with the gun mounted on the tripod. To construct the T-shaped fighting position, follow the steps listed below as you look at figure 5-1 :

Note: When only one sector of fire has been assigned, make only one firing platform.

(1) Lay the machinegun on the direction(s) of fire and mark the location of firing platform(s). The firing platform should measure 3 feet by 3 feet.

(2) Dig around the firing platform to provide room for you to move freely to a depth up to your armpits. For cover, place the dirt you removed around your fighting position.

(3) Dig a grenade sump at each leg position. The grenade sump must be

(a) As wide as the entrenching tool blade

(b) At least as deep as the length of an entrenching tool

(c) As long as the width of the position floor

Note: The floor of all positions should slope toward the grenade sumps.

(4) Camouflage the position in a way that does not obstruct the machinegun's operation.

Notes: When firing in the primary direction of fire, mount machinegun on the tripod.

If you engage the enemy in the secondary sector, remove machinegun from the tripod and employ the machinegun in the secondary sector using the bipod.

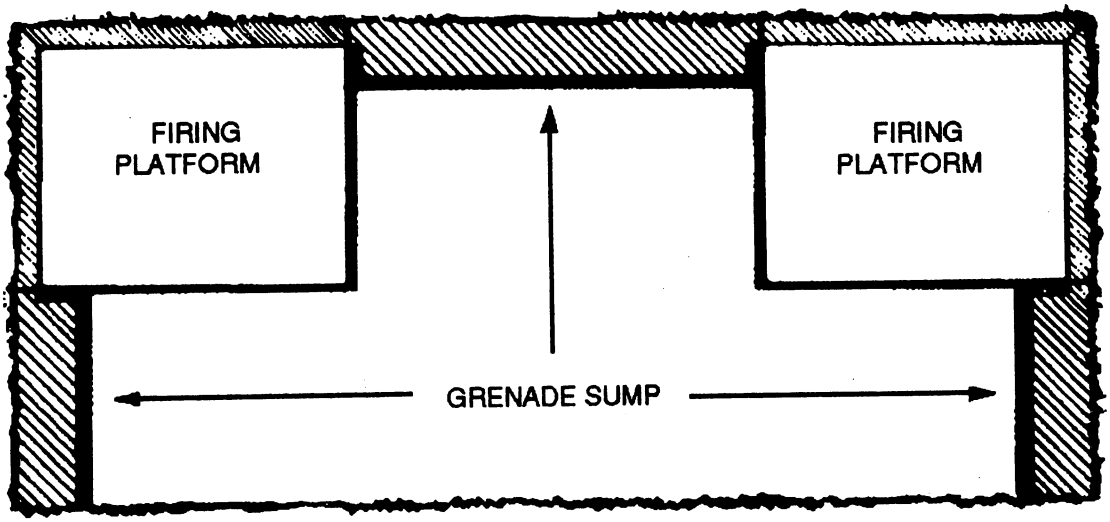


Fig 5-1. T-shaped position.

b. L-shaped position. Construct the L-shaped machinegun fighting position only when one sector of fire is assigned. Basically, think of the L-shaped position as half of the T-shaped position. The L-shaped fighting position allows easy 180 degree traverse across the front. Its disadvantage is that it provides less protection against indirect fire. You can only engage the enemy to your front and flanks while you remain covered in the fighting hole (see fig 5-2).

To construct the L-shaped fighting position, follow the steps listed below:

(1) Lay the machinegun on the direction of fire(s) and mark the location of gun platform(s). The gun platform should measure 3 $\frac{1}{2}$ feet wide by 3 $\frac{1}{2}$ feet deep.

(2) Dig around the gun platform with the following dimensions: two bayonets wide and 2 feet deep. For cover, place the dirt you removed around the flanks and rear of the machinegun position to form a parapet. This parapet should be 3 feet thick and 1 foot away from the edge of the hole.

(3) Dig a grenade sump at each leg position just as you did for the T-shaped position.

(4) Camouflage the position in a way that does not obstruct the machinegun's operation.

Note: When switching from the primary to the alternate sector of fire, the gunner and team leader switch roles even though they staying in place.

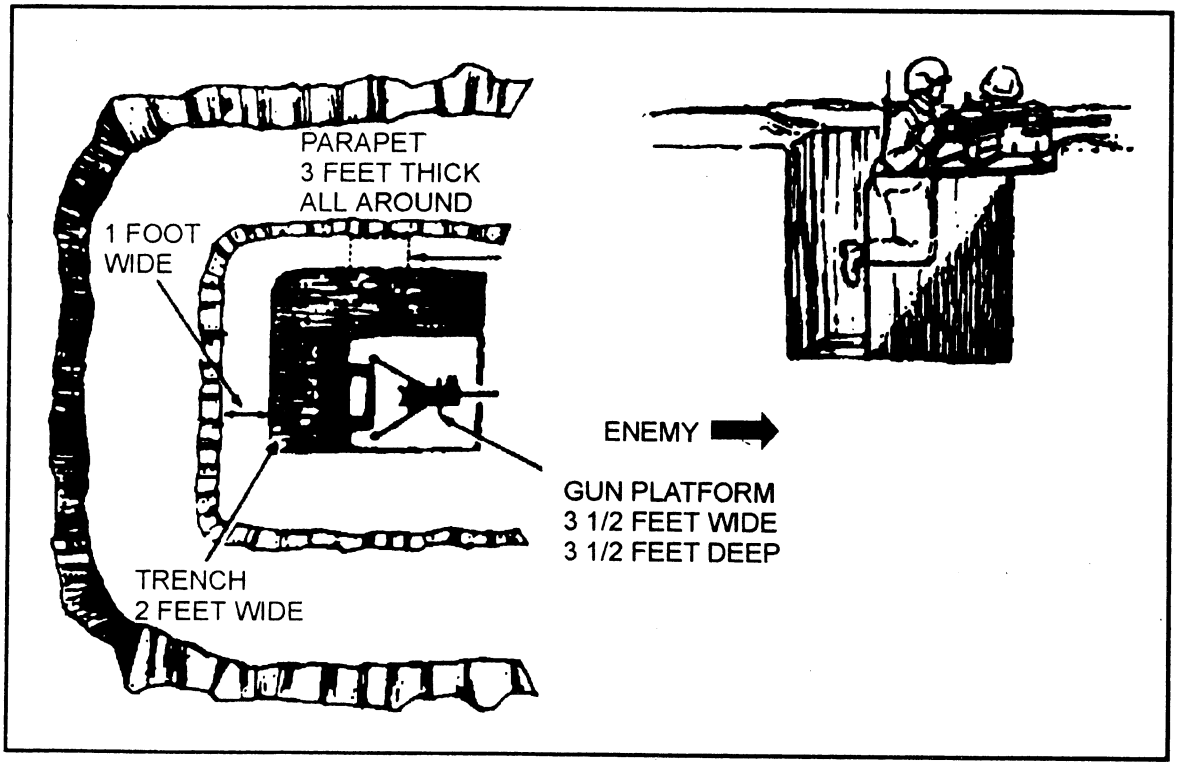


Fig 5-2. L-shaped position.

c. Horseshoe-shaped position. The horseshoe-shaped fighting position allows easy 180 degree traverse across the front. Its disadvantages are that it provides less protection against indirect fire, and you can only engage the enemy to your front and flanks while you remain covered in the fighting hole (see fig 5-3).

To construct the horseshoe-shaped fighting position, follow the steps listed below:

(1) Lay the machinegun on the direction of fire and mark the location of the gun platform. The gun platform should measure 3 feet by 3 feet.

(2) Dig around the gun platform to a width of two bayonets. The depth may vary. For cover, place the dirt you removed around the position to form a 3-foot wide parapet.

(3) Dig a grenade sump in the rear position.

(4) Camouflage the position in a way that does not obstruct the machinegun's operation.

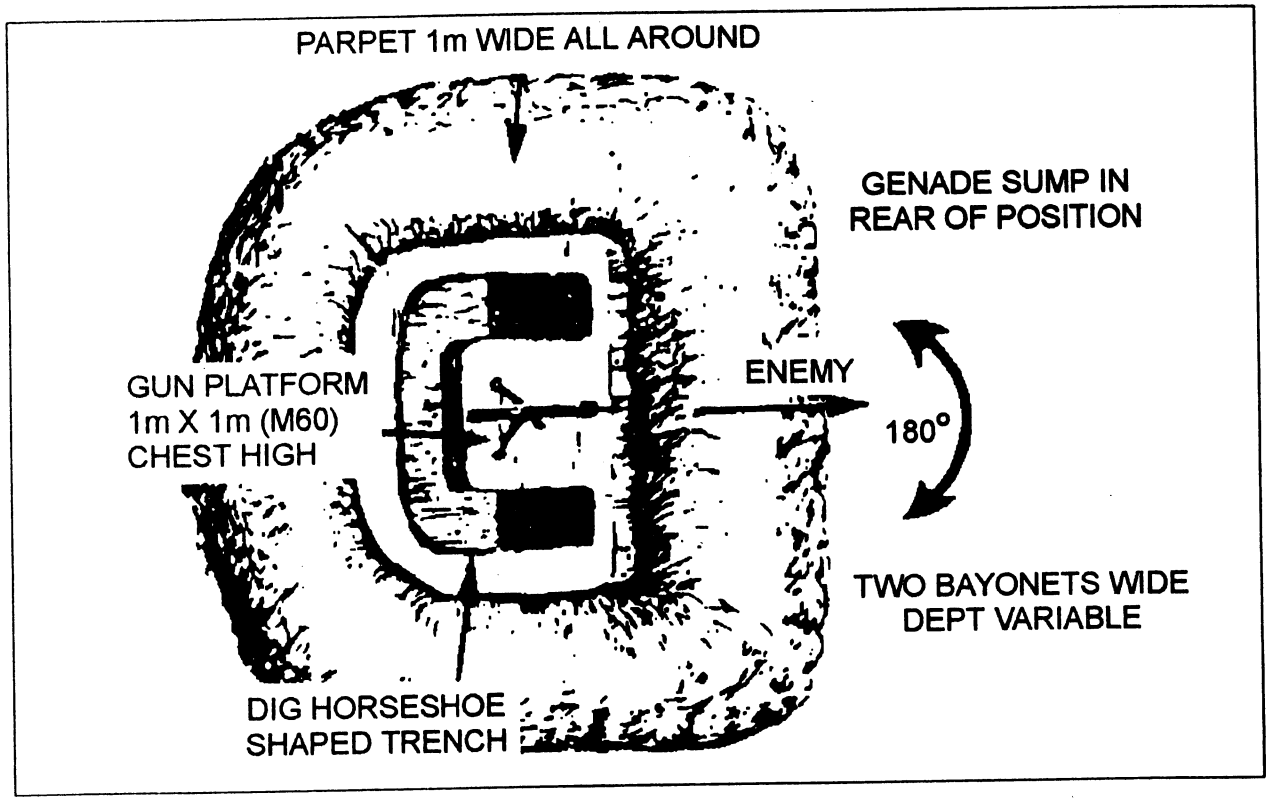


Fig 5-3. Horseshoe-shaped position.

d. Two-hole position. The two-hole position uses two one-man fighting holes at a 90 degree angle to each other. The advantages of this position are that it provides excellent protection for the gunner and the team leader, and it covers primary and alternate sectors of fire. Its disadvantage is that it offers limited traverse of the gun. Refer to figure 5-4 as you read the following steps:

(1) Lay the machinegun on the direction of fire and mark the location of the gun position.

(2) Dig around the gun position that is armpit deep. For cover, place the removed dirt around the position to form a parapet that is 3 feet wide.

(3) Dig a grenade sump in the rear position.

(4) Camouflage the position in a way that does not obstruct the machinegun's operation.

Notes: When switching from the primary to the alternate sector of fire, the gunner and the team leader switch roles, but not positions.

As time permits, improve the positions by constructing overhead cover. Use logs to provide cover from indirect fire. Cover the logs with a poncho to keep out the elements. Remember, always improve your position!

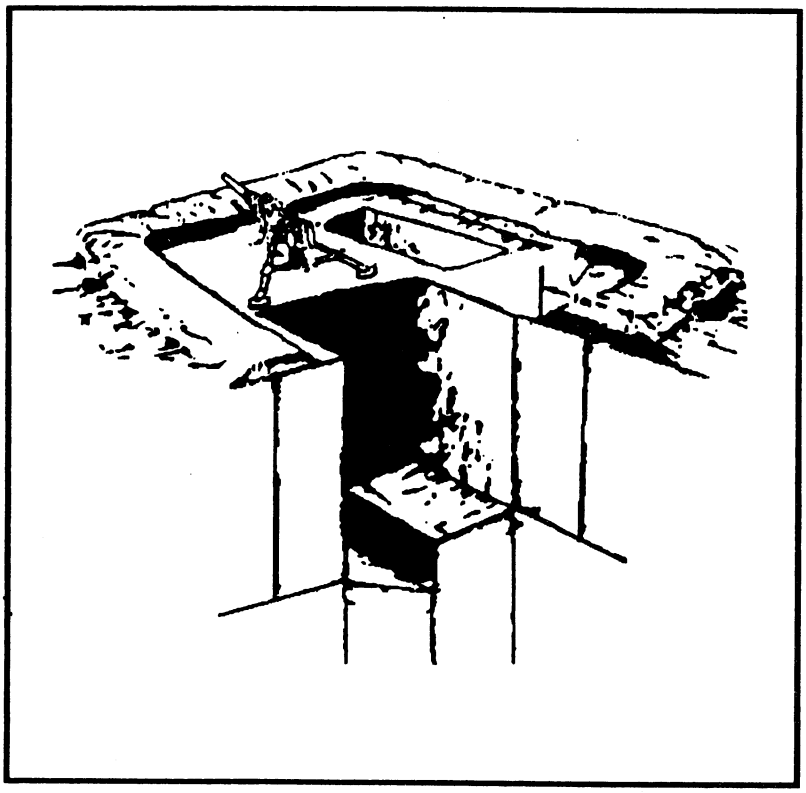


Fig 5-4. Two-hole position.

5203. Prepare a Hasty Defensive Position

Contact with the enemy often occurs when you least expect it. When contact is made with little or no warning, time will not allow you to construct one of the preplanned positions. In this situation you occupy a hasty position. A hasty position is any position that provides you sometype of cover. This could be a hole, a depression in the ground, a tree, or anything that provides cover from enemy fire. Once you are in position, follow the steps listed below:

a. Lay the machinegun on your sector of fire.

b. Improve your position as time permits by doing the following:

(1) Dig or scrape out the hole.

(2) Build up the position with logs, etc.

(3) Camouflage the position.

Lesson Summary. This lesson discussed the priority of work, the types of machinegun positions, their dimensions, their advantages and disadvantages, and hasty defensive positions. When the occasion arises, you will be able to make the proper decision about which machinegun position to construct. The next lesson covers gun drills and qualifying with the M240G.

Lesson 3. LEARNING ABOUT GUN DRILLS AND QUALIFICATION

LEARNING OBJECTIVES

1. Identify the equipment for which each crew member is responsible during gun drills.
2. Identify gun drill commands.
3. Identify each team member's new duty during gun drill rotation.
3. Identify the sequence of fire to qualify with the M240G.
4. Identify the time limits for each stage of fire during qualification.
5. Identify the scoring system during qualification.

As discussed throughout this course, being a machinegunner carries the awesome responsibility of putting accurate, continuous fire on the enemy. How can you become an effective machinegunner? Quite simply, the answer is though practice.

When you practice firing the weapon, you accomplish accuracy, zeroing, and qualification, but much more is required. Precision and speed are also essential for mission accomplishment. For example, picture yourself exposed to the enemy's fire while you are on the attack. As you wait and wait for your machineguns to open fire, your platoon is being destroyed. Will it matter how accurately your machineguns fire once they begin if no one is left in the assault element? Definitely not. Machinegunnery requires both speed and accuracy.

Practice your skills through gun drills. When an individual Marine practices his skills during gun drills, he develops both precision and speed. For a group of Marines, gun drills provide an opportunity for them to develop as a team. Since practice and training through gun drills does not require having a "range locked on," you can do it almost any time or place. The benefits of practice through gun drills cannot be overstated.

Putting your Marines through rotation of duties allows them to practice skills throughout the unit. Marines who rotate duties develop proficiency as individuals and as a unit.

5301. Crew Equipment

Each member of the machinegun team carries his individual arms and the equipment listed below:

- Squad leader - Binoculars and compass
- Team leader - Tripod and one can of ammunition
- Gunner - Machinegun with one bandoleer of ammunition
- Ammunition bearer - The spare barrel bag, flex mount with T&E mechanism, and one box of ammunition

5302. Commands

There are several commands for gun drills. The team leader repeats each command received from the squad leader. The command, responsibilities, and position of each team member are listed below:

a. Fall in. The team leader repeats the squad leader's command. The machinegun team forms on line with five paces between each team member (see fig 5-5).

Fig 5-5. Falling in for gun drills.

b. Take equipment. The team leader repeats the squad leader's command. The team members take one step forward and pick up their gear.

c. Form for gun drill. The team leader repeats the squad leader's command. The gun team forms in a column with the team leader in front facing the squad leader. The team falls into the following order: team leader, gunner, ammunition bearer. All members are in the prone position with five paces between them (see fig 5-6).

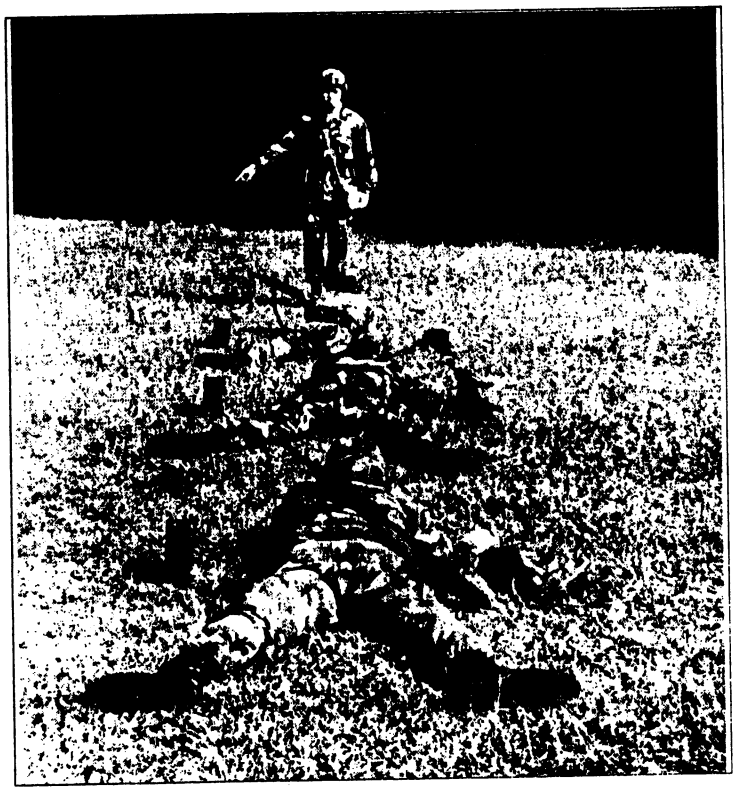


Fig 5-6. Form for gun drills.

d. Examine equipment. The team leader repeats the squad leader's command. Each crew member's responsibility for equipment examination is listed below:

Note: All members remain in the prone position throughout the examination.

(1) Team leader's examination

(a) Team leader examines the ammunition by opening the can, releasing the cloth flaps, and pulling out the cardboard flaps of the bandoleer.

(b) Team leader examines the ammunition to ensure it is properly linked and free of dirt and corrosion. He ensures the double link is up and ready for loading.

Note: Do not remove the belts from the bandoleer for examination.

(c) Team leader reinserts the cardboard flaps in the bandoleer, closes the cloth cover, places the ammunition back into the can, and closes the can.

(d) Team leader places the ammunition can to his left.

(e) Team leader examines the tripod by ensuring the legs are folded closely together. He uses his right hand to check the sleeve latch to ensure it has tension functions.

(2) Gunner's examination

(a) Gunner examines the ammunition in the same manner as the team leader.

(b) Gunner examines the gun by locking the bolt to the rear; he then places the gun on safe, raises the feed tray cover, and ensures the chamber and gun are clear.

(c) Gunner crawls forward and looks though the barrel to ensure the bore is clean.

(d) Gunner checks the flash hider for cracks. Gunner checks the front sight for tightness and damage to the front sight blade.

(e) Gunner ensures the collar on the gas system is properly affixed to the plug. Gunner ensures the collar is on the number 1 setting.

(f) Gunner checks to ensure the barrel cocking handle moves freely. Gunner ensures the feed arm, pivot arm, and feed arm fork are lubricated and move freely.

(g) Gunner checks the feed pawls for the proper tension.

(h) Gunner places the gun in Condition 4.

(i) Gunner sets the rear sight to the 500-meter setting.

(j) Gunner assumes a position to the left of the gun with his head in line with the feed tray.

(3) Ammunition bearer's examination

(a) Ammunition bearer examines the ammunition in the same manner as the team leader.

(b) Ammunition bearer removes the flex mount and the T&E mechanism from the spare barrel bag.

(c) Ammunition bearer ensures the elevating handwheel is centered so that approximately $1\frac{1}{2}$ inches of thread is exposed above and below the handwheel.

(d) Ammunition bearer centers the offset head.

(e) Ammunition bearer checks the locking lever on the traversing slide to ensure it moves freely.

(f) Ammunition bearer inspects the flex mount to ensure the locking pin is present and the pintle is clean and free of burrs.

(g) Ammunition bearer inspects spare barrel by ensuring the barrel socket is clean.

(h) Ammunition bearer checks the spare barrel bag's accessory pocket to ensure all SL-3 components are present, then he returns all equipment to the bag.

e. Reports. Once the inspection is completed, the squad leader gives the command: **"Report."** Each member reports any discrepancies he could not correct. If the equipment is correct, the members report it in the following manner:

(1) The ammunition bearer reports: **"Ammunition bearer correct."**

(2) The gunner reports: **"Ammunition bearer and gunner correct."**

(3) The team leader reports: **"All correct."**

f. Placing the gun into action. When the squad leader decides to give the command to put the gun into action, he says: **"Gun to be mounted here, front, action."** Listed below are the commands for and response from each team member:

(1) Team leader' actions

(a) Team leader rises to his feet, grasps the right leg of the tripod near the tripod head with his right hand, and grasps the ammunition box with his left hand. He rotates the tripod onto his right hip, with the left leg of the tripod up, and moves forward to the gun position.

(b) Team leader places the ammunition to the front so it will be approximately on line with the tripod head when the tripod is opened.

(c) Team leader kneels on his right knee and rests the shoes of both tripod legs on the ground with the mount in a vertical position, chest high.

(d) Team leader steadys the mount with his right hand near the tripod head while raising the front leg with his left hand. He grasps the right leg shoe with his right hand, the left leg shoe with the left hand, and raises the tripod to a vertical position, chest high.

(e) The team leader separates the tripod legs with a quick jerk, ensuring the sleeve latch engages. This locks the tripod in its open position.

(f) Team leader places the tripod on the ground with the front leg pointing in the direction of fire.

(g) Team leader rises to his feet and stamps the rear legs into the ground.

(h) Team leader assumes a prone position on his left hip on the left side of the tripod.

(2) Ammunition bearer's action

(a) Ammunition bearer arrives at the gun position at the time the team leader assumes his position.

(b) Ammunition bearer rises, takes the spare barrel case by the handle with his right hand, and takes the ammunition box with his left hand. He moves up to the gun position.

(c) Ammunition bearer removes the flex mount from the spare barrel case and hands it to the team leader, who immediately inserts the pintle into the pintle bushing and locks it down.

(d) Then, the team leader lowers the traversing slide over the traversing bar of the tripod, centers it on the "0" graduation line of the traversing bar, and locks it down.

(e) While the team leader is affixing the flex mount to the tripod, the ammunition bearer places the spare barrel case approximately on line with the point where the muzzle of the gun will be when it is mounted. He places the ammunition box one pace to the left and on line with the spare barrel case.

(f) Ammunition bearer opens the spare barrel case, removes the spare barrel, and places it on top of the case with the muzzle pointing down range and the sight toward the gun.

(g) Ammunition bearer moves to the flank to provide security.

(3) Gunner's actions

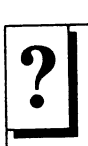
(a) Gunner times himself to arrive at the gun position as the team leader receives the flex mount from the ammunition bearer.

(b) Gunner rises, grasps the barrel changing handle in his right hand and the bandoleer of ammunition in his left hand.

(c) Gunner moves forward to the gun position and places ammunition to the left of the tripod.

(d) Gunner slides the recesses in the receiver into the mount's forward bushings, rotates the gun down into position on the rear of the mount, and inserts the locking pin to secure the gun to the mount.

(e) Gunner assumes the prone position. When ready to fire, gunner reports "UP" to the team leader, who reports "UP" to the squad leader.



What primary things does each team member check in their respective inspections?

uuu

I hope your answer was something like this: "All three check ammo; the team leader checks the tripod; the gunner checks the gun for cleanliness, cracks, and free movement of major parts; the ammo bearer affixes the T&E mechanism and checks parts, spares, and bag contents."

Now you can see that these inspections really do require teamwork!

g. Changing barrels. Listed below are the correct commands and responses by each team member when changing barrels.

Note: Team leader has reported "UP."

(1) Squad leader commands: **"Change Barrel."**

(2) Gunner places the weapon on safe, then depresses the barrel-locking latch. He keeps his hand on the barrel release latch throughout the barrel change.

(3) Team leader grasps the barrel changing handle and removes the barrel from the machinegun, placing it on the deck to the left of the spare barrel case. Team leader then grasps the spare barrel by the changing handle and inserts it into the gun.

(4) Gunner depresses the barrel-locking latch to assist the team leader in securely seating the barrel. Gunner places the safety on fire and resumes firing position.

(5) Team leader reports "UP" to the squad leader.

h. Taking the machinegun out of action. Listed below are the correct commands and responses by each team member after the squad leader commands: **"Out of Action."**

(1) Gunner

(a) Gunner raises the cover and inspects the receiver and chamber to ensure they are clear.

(b) Gunner closes the cover, pulls the trigger, and places the safety on SAFE.

(c) Gunner secures the ammunition.

(d) Gunner removes the locking pin from the flex-mount, elevates the rear of the gun, and removes it from the mount.

(e) Gunner lowers the rear sight, grasps the carrying handle with his right hand, raises the gun, and rises to his feet.

(f) Gunner grasps the ammunition with his left hand, pivots to the right, and returns to his original position.

(2) Team leader

Team leader unlocks the traversing slide, unlocks the pintle latch, and removes the flex mount from the tripod.

(3) Ammunition bearer

(a) Ammunition bearer arrives at the gun position before the team leader and removes the flex-mount.

(b) Ammunition bearer places the spare barrel in its case, receives the flex-mount from the team leader, and places it in the spare barrel case.

(c) Ammunition bearer closes the spare barrel case and grasps it with his right hand. He grasps the ammunition box with his left hand and returns to his original position.

(4) Team leader

(a) Team leader grasps the tripod near its head, rotates it up onto his right hip so that the left tripod leg is uppermost.

(b) Team leader grasps the ammunition with his left hand, turns left, and returns to his original position.

(c) Team leader places ammunition on the deck and drops to his right knee.

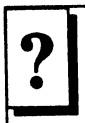
(d) Team leader places the tripod in a vertical position with the tripod's rear shoes on the deck. Team leader supports the tripod with his right hand near its head.

(e) Team leader reaches up with his left hand and lowers the tripod's front leg.

(f) Team leader slides his right hand down the tripod's right leg and releases the sleeve latch.

(g) With his left hand, team leader grasps the tripod's left leg near the shoe and closes it to the right.

(h) Team leader lowers the tripod to the deck with its head to the front. Team leader assumes the prone position and reports "UP."



Do you remember the major responsibilities of the team members when they are ordered to put the gun in action? uuu Hopefully, your answer is similar to this:

"Team leader carries and sets up tripod and ammo. Ammo bearer carries the spare barrel case and ammo box and opens and arranges everything for the gunner. The gunner finishes affixing everything and prepares to fire."

i. Rotation of duties. The command for rotation of duties is **"Fall Out Squad Leader."** On that command, the team leader assumes the squad leader's position, and all remaining members rise and move up one position. As the team members move to their new positions, each calls out his new duties in the following order: ammunition bearer, gunner, team leader, and squad leader. The new squad leader now starts gun drills to ensure everyone rotates through each position.

5303. Qualification

As the machinegunner, you will be required to demonstrate your proficiency by qualifying with the M240G machinegun. Qualification requires you to engage targets from 12.7 meters using the different classes of fire within a set time limit. Before you start the qualification course, set the range on the sight to 500 meters and confirm zero. This course requires 150 rounds of ammunition. Below are listed the steps and commands of each team with the number of rounds used to engage each target, the method of engagement, and the time limits.

Notes: Divide the ammunition into four 6-round belts, one 30-round belt, and two 48-round belts.

Use the prone position while qualifying.

a. Engage point targets. Engage targets 1 through 4 within 30 seconds.

(1) Squad leader. Issues this command: **"With a 6-round belt, load, paster number 1 (2, 3 or 4), 500, fixed, 6-round burst, at my command, fire."**

(2) Team leader. Loads the machinegun with a 6-round belt

(3) Gunner. Manipulates the traversing and elevating (T&E) mechanism to obtain sight alignment and sights picture at 6 o'clock on the black paster of target (A) 1 through 4 (see fig 5-7).

(4) Gunner. Engages targets as directed.

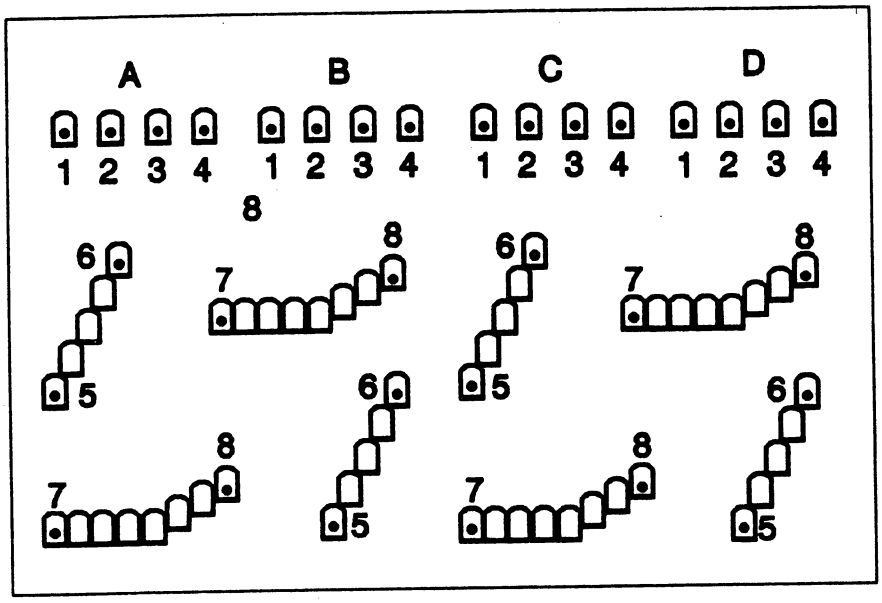


Fig 5-7. Basic machinegun qualifying target.

b. Engage wide targets. Engage targets 7 through 8 with a single 48-round belt by first using a traverse manipulation, then by a traverse and search manipulation.

(1) Engage targets 7 through 8 with a single 48-round belt by first using a traverse manipulation, then by a traverse and search manipulation.

Notes: Time limit to engage targets 7 through 8 is 60 seconds.

Manipulation changes are only good if the previous rounds are centered on the silhouette.

(2) Aim and fire an initial burst at the 1st paster of targets 7 through 8.

Note: Ensure you have correct body alignment before making any manipulation changes.

(3) Move right 2 clicks and fire another 6-round burst.

(4) Repeat step 3, three more times.

c. Engage oblique targets

(1) Move right 2 clicks and up 1 click, then fire a 6-round burst.

(2) Repeat procedure above, engaging the next 2 squares.

d. Engage deep targets

(1) Engage targets 5 through 6 with a single 30-round belt, using a traverse and search manipulation.

(2) Aim and fire a 6-round burst at the 1st paster of targets 5 through 6.

(3) Traverse right 1 click and elevate up 2 clicks, then fire another 6-round burst.

(4) Repeat above step for each remaining square of targets 5 through 6.

Note: The time limit to engage targets 5 through 6 is 60 seconds.

(5) Complete qualification by engaging targets 7 through 8 with a single 48-round belt, first using a traverse and search manipulation, then by traverse manipulation alone.

Notes: Engage targets 7 through 8 with the opposite, or reverse, manipulation used for targets 7 through 8.

Start with paster 8 and progress down and left for 3 squares, then progress left for the remaining squares with 6-round bursts until finished.

The time limit to engage targets 8 through 7 is 60 seconds.

e. Determining score

(1) Score 1 point for each bullet hole in a scoring square up to a total of 6 holes.

(2) Award a bonus of 2 points for hitting any scoring square.

(3) A gunner may receive a maximum of 8 points per square (6 points for 6 hits, plus 2 bonus points).

(4) Count a bullet hole on the line between 2 squares in either square, but not in both.

(5) If a line is hit between squares, the shot should be scored in the square which will allow the higher score (taking into consideration the bonus of 2 points for engaging each square as opposed to no bonus for not engaging a square).

(6) Classify the gunner's score using table 5-1 below.

Table 5-1. Qualification Scoring Table

SCORE	CLASSIFICATION
150 and over	Expert
130 - 149	First Class Gunner
105 - 129	Second Class Gunner
104 and below	Unqualified

Lesson Summary. In this lesson, you learned how to employ the machinegun using the principles and characteristics of machinegun employment. This lesson also covered how to run gun drills and the steps required to qualify with the M240G machinegun. In the following study unit exercise you can assess how much you have learned. Good luck!

Study Unit 5 Exercise: Complete items 1 through 33 by performing the action required. Check your responses against those listed at the end of this study unit.

1. There are eight principles of machinegun employment. Four of these are

   Employed in pairs
   Coordination of fire
   Positioned in defilade
   Position to produce enfilade fire

   What are the other four?

   a. Interlocking fire
      Cover and concealment
      Base of fire
      Mutual support

   b. Interlocking fire
      Dig deep
      Economy
      Mutual support

   c. Interlocking fire
      Cover and concealment
      Economy
      Mutual support

   d. Indirect fire
      Cover and concealment
      Economy
      Mutual support

2. What principle does the following statement represent?

"Every machinegun should be able to provide support for another machinegun."

a. Employed in pairs
b. Interlocking fire
c. Mutual support
d. Economy

3. What principle does the following statement represent?

"While one Marine is reloading, the other Marine can continue to fire."

a. Employed in pairs
b. Interlocking fire
c. Mutual support
d. Economy

4. What principle does the following statement represent?

"Look for dead space along the FPL, making sure you hit the enemy before he gets to cover."

a. Cover and concealment
b. Interlocking fire
c. Mutual support
d. Coordination of fire

5. What principle does the following statement represent?

"Make it difficult for the enemy to place effective fire on your position."

a. Cover and concealment
b. Position in defilade
c. Mutual support
d. Coordination of fire

6. What is the most effective fire to engage targets?

a. Cover and concealment
b. Interlocking
c. Mutual support
d. Enfilade

7. _____ provides a wall of steel in front of your position.

a. Cover and concealment
b. Interlocking fire
c. Mutual support
d. Coordination of fire

8. What principle does the following represent?

"Hiding and protecting your position from the enemy"

a. Cover and concealment
b. Interlocking fire
c. Mutual support
d. Coordination of fire

9. What principle does the following represent?

"Talking guns"

a. Cover and concealment
b. Economy
c. Mutual support
d. Coordination of fire

10. Select the correct list of steps for establishing a base of fire.

a. Select firing position
Determine range to target
Lay the gun on target
Determine safety limits for overhead fire
Respond to fire command
Adjust fires
Displace on order
Protect against counterattack

b. Select firing position
Determine range to target
Lay the gun on target
Determine safety limits for overhead fire
Respond to fire command
Call for indirect fires
Displace on order
Protect against counterattack

c. Select firing position
Select Target
Lay the gun on target
Determine safety limits for overhead fire
Respond to fire command
Do not adjust fires
Displace on order
Protect against counterattack

d. Select firing position
Target
Lay the gun on sight
Determine safety limits for overhead fire
Respond to fire command
Adjust fires
Displace on order
Protect against counterattack

11. The two manual ways to destroy the M240G are

a. mechanical and burning.
b. mechanical and blowing up.
c. machinery and burning.
d. mechanical and throwing away.

12. Three ways to destroy M240G ammunition are to use explosives, to bury it, and to

a. take it apart.
b. burn it.
c. smash it.
d. fire it.

13. What does the acronym "SAFE" mean?

S _____

A _____

F _____

E _____

14. The four types of preplanned positions are T-shaped, L-shaped, horseshoe, and

a. one-man.
b. poncho.
c. two-hole.
d. log-shaped.

15. When would you use a hasty position?

a. When surprised by the enemy
b. During gun drills
c. For preplanned fire
d. When under indirect fire

Matching: Match the member of the machinegun team in column 1 with the equipment he carries in column 2.

Column 1		Column 2	
Member		Equipment	
___	16. Squad leader	a.	Machinegun with one bandoleer of ammo
___	17. Team leader	b.	Binoculars and compass
___	18. Gunner	c.	Tripod and one can of ammo
___	19. Ammunition bearer	d.	The spare barrel bag and one box of ammo

20. The command to put the M240G into action is

a. "Gun # 3 Mount Here, Front, Action."
b. "Gun #3 Direct Front, Action."
c. "Gun #3 Mount Here, Shoot."
d. "Gun #1 Mount There, Shoot When Ready."

21. The command to take the M240G out of action is

a. "Move."
b. "Disassembly."
c. "Out of Action."
d. "Action Here."

22. The command to change the barrel is

a. "Change Barrel."
b. "Cease Fire, Change Barrel."
c. "Stop Firing, Change Barrel."
d. "Stop Firing."

Matching: Match the duty of each team member before rotation in column 1 with his new duty after rotation in column 2.

Column 1 Duty before rotation	Column 2 Duty after rotation
___ 23. Squad leader	a. Squad leader
___ 24. Team leader	b. Team leader
___ 25. Gunner	c. Gunner
___ 26. Ammunition bearer	d. Ammunition bearer

27. Choose the correct sequence for qualifying with the M240G.

a. Engage point targets.
Engage wide targets.
Engage oblique targets.
Engage deep targets.

b. Engage deep targets.
Engage wide targets.
Engage oblique targets.
Engage point targets.

c. Engage point targets.
Engage deep targets.
Engage wide targets.
Engage oblique targets.

d. Engage enfilade targets.
Engage deep targets.
Engage wide targets.
Engage oblique targets.

28. Identify the correct time limits for each stage of qualification.

a. Targets 1-4, 30 seconds
Targets 7-8, 60 seconds
Targets 5-6, 60 seconds
Targets 8-7, 60 seconds

b. Targets 1-4, 45 seconds
Targets 7-8, 60 seconds
Targets 5-6, 60 seconds
Targets 8-7, 60 seconds

c. Targets 1-4, 60 seconds
Targets 7-8, 60 seconds
Targets 5-6, 60 seconds
Targets 8-6, 60 seconds

d. Targets 1-4, 60 seconds
Targets 7-8, 90 seconds
Targets 5-6, 60 seconds
Targets 8-6, 60 seconds

Matching: Match the classification in column 1 with its score range in column 2.

Column 1		Column 2	
Classification		Score	
___	29. Expert	a.	130 - 149
___	30. First class gunner	b.	105 - 129
___	31. Second class gunner	c.	150 and over
___	32. Unqualified	d.	104 and below

33. The maximum number of points on a square using the basic machinegun qualification target is

a. 6.
b. 7.
c. 8.
d. 12.

UNIT SUMMARY

This study unit provided basic knowledge about how to employ the M240G and the different fighting positions. You learned each member's position and commands during gun drills. You also learned the types of targets and the steps for qualifying with the M240G. Compare your responses with those provided.

Study Unit 5 Exercise Solutions

		Reference
1.	c.	5101
2.	c.	5101
3.	a.	5101
4.	d.	5101
5.	b.	5101
6.	d.	5101
7.	b.	5101
8.	a.	5101
9.	b.	5101
10.	a.	5102
11.	a.	5103
12.	d.	5103
13.	Security Assign automatic weapons Clear fields of fire Entrench	5201
14.	c.	5202
15.	a.	5203
16.	b.	5301
17.	c.	5301
18.	a.	5301
19.	d.	5301
20.	a.	5302
21.	c.	5302
22.	a.	5302
23.	d.	5302
24.	a.	5302
25.	b.	5302
26.	c.	5302
27.	a.	5303
28.	a.	5303
29.	c.	5303
30.	a.	5303
31.	b.	5303
32.	d.	5303
33.	c.	5303

APPENDIX A

Training Standards

The individual training standards (ITSs) listed below are from MCO 1510.35c, duty areas 1 and 2.

TASK #	TASK TITLE	RANK
DUTY AREA 1 - MACHINEGUN GUNNERY		
0331.1.1	Construct a Machinegun Position	PVT
0331.1.2	Lay a Machinegun	PVT
0331.1.3	Determine Range by Fire	PVT
0331.1.4	Prepare a Range Card for a Machinegun	PVT
0331.1.5	Operate as a Member of a Machinegun Team (Gun Drills)	PVT
0331.1.6 *	Maintain the Crew-Served Weapon Night Vision Sight AN/TVS-5	LCPL
0331.1.7	Engage Targets with a Machinegun from Position Defilade	LCPL
0331.1.8	Engage Targets with a Machinegun Using Overhead Fire	LCPL
0331.1.9	Engage an Air Target with a Machinegun	LCPL
0331.1.10	Direct the Maintenance of Machineguns	CPL
0331.1.11	Control Machinegun Team Fires	CPL
0331.1.12	Control Machinegun Team Fires from Position Defilade	CPL
0331.1.13	Control Overhead Fires of a Machinegun Team	CPL
0331.1.14 *	Control HMG Section Vehicle Movement	SGT
0331.1.15 *	Control Mounted HMG Unit Tactical Movements	SGT
0331.1.16	Direct the Employment of Machineguns in the Defense	SGT
0331.1.17	Establish a Machinegun Base of Fire	SGT
DUTY AREA 2 THE M240G 7.62 MACHINEGUN		
0331.2.1	Maintain the M240G Machinegun	PVT
0331.2.2	Zero the M240G Machinegun	PVT
0331.2.3	Engage Targets with the M240G at Known Distance (Qualification)	PVT
0331.2.4	Engage Targets with the M240G at Unknown Distance	PVT
0331.2.5	Engage Targets with the M240G Using Predetermined Data	PVT
0331.2.6	Field Zero a Night Vision Sight to an M240G	PVT
0331.2.7	Engage Targets with the M240G Using the Night Vision Sight	PVT
0331.2.8	Destroy the M240G to Prevent Capture	PVT

* Indicates the task was not covered in 03.21 *The M240G Machingunner*

APPENDIX B

M60E3/M240G Firing Tables

Table 1

Angles of Elevation, Dimension of Cone and Beaten Zone, Angles of Fall, Times of Flight, and Drift - How to Use

The angle of elevation required to engage a target on flat or uniformly sloping ground is listed for the indicated ranges.

The mil difference between two successive angles of elevation has been calculated to permit subsequent changes in the quadrant elevation without recalculation.

The vertical 100 percent cone, effective 82 percent beaten zone, angle of fall, and time of flight are listed to assist in determining effect on target.

For ranges not in even hundreds and for ranges not tabulated, the desired information must be determined by interpolation.

Example: The range to target is 1000 meters. The angle of elevation is 16.2 mils. The difference between the AE of 900 meters and 1000 meters is 3.1 mils. The vertical 100 percent cone is 3.3 mils or 3.2 meters. The effective 82 percent beaten zone is 2 mils and 2 meters wide as well as 50 meters long. The angle of fall is 33 mils and the time of flight to the target is 2.11 seconds.

Angles of Elevation, Dimension of Cone and Beaten Zone, Angles of Fall, Time of Flight, and Drift

Cartridge, Ball M59					FT 7.62				
Range	Angle of Elevation	Difference	Vertical 100% Cone		Effective 82% Beaten Zone Width		Length	Angle of Fall	Time of Flight
M	Mil	Mil	Mil	M	Mil	M	M	Mil	Sec
100	0.7	-	2.7	0.3	-	-	-	1	0.13
200	1.6	0.9	2.4	0.5	-	-	-	2	0.27
300	2.6	1	2.1	0.6	-	-	-	3	0.42
400	3.7	1.1	2.4	0.9	-	-	-	5	0.58
500	5	1.3	2.4	1.2	2	1	86	7	0.76
600	6.5	1.5	2.5	1.5	-	-	-	10	0.97
700	8.3	1.8	2.7	1.8	-	-	-	14	1.21
800	10.5	2.2	2.8	2.2	-	-	-	19	1.48
900	13.1	2.6	3.1	2.7	-	-	-	26	1.78
1000	16.2	3.1	3.3	3.2	2	2	50	33	2.11
1100	19.9	3.7	3.6	3.9	-	-	-	42	2.46
1200	24.1	4.2	3.8	4.5	-	-	-	51	2.83
1300	28.8	4.7	4.1	5.2	-	-	-	61	3.22
1400	34	5.2	4.4	6	-	-	-	72	3.63
1500	39.7	5.7	4.7	6.9	2	3	42	84	4.06
1600	45.9	6.2	5.1	7.9	-	-	-	97	4.51
1700	52.6	6.7	5.4	9.1	-	-	-	111	4.95
1800	59.9	7.3	5.9	10.5	-	-	-	128	5.37
1900	67.8	7.9	6.4	12	-	-	-	146	5.99
2000	76.4	8.6	7	13.8	2	4	42	166	6.54
2100	85.8	9.4	7.6	15.7	-	-	-	188	7.12
2200	96.1	10.3	8.4	18	-	-	-	213	7.73
2300	107.3	11.2	9	20.4	-	-	-	240	8.38
2400	119.4	12.1	10	23.4	-	-	-	271	9.06
2500	132.5	13.1	10.8	26.5	3	6	43	304	9.78
2600	146.8	14.3	11.9	30.3	-	-	-	341	10.54
2700	162.5	15.7	13	34.5	-	-	-	381	11.35
2800	179.9	17.4	14.4	39.4	-	-	-	425	12.25
2900	199.2	19.3	15.9	45.3	-	-	-	475	13.15
3000	220.6	21.4	17.6	51.8	3	9	46	527	14.15
3100	244.4	23.8	19.8	60.2	-	-	-	585	15.23
3200	271.1	26.7	22.1	69.4	-	-	-	648	16.41
3300	301.7	30.6	25.1	81.3	-	-	-	716	17.72
3400	337.77	36	28.5	95.1	-	-	-	790	19.2
3500	381.2	43.5	33.1	113.9	3	12	50	871	20.91
3600	437.4	56.2	39.1	138.2	-	-	-	962	23.04
3700	532.7	95.3	-	-	-	-	-	1088	26.42
3725	608.5	75.8	-	-	-	-	-	1167	28.96

Table II

Overhead Fire - How To Use

Troop distance in column 1 is the distance in meters from the gun to the friendly troops over whose heads you desire to fire.

The quadrant elevation required to strike the ground upon which the troops stand, plus a definite angle of safety, gives the *minimum quadrant elevation* that can be fired without danger over the troops.

The safety angle varies with the range. The minimum quadrant elevation that can be fired with safety over the heads of friendly troops is comprised of the following factors:

- Safety angle (corresponding to troop distance)
- Angle of elevation (corresponding to troop distance)
- Angle of site

The safety angle plus the angle of elevation constitute the *minimum angle of elevation* that can be fired over the heads of friendly troops at the given troop distance. The minimum angles of elevation are listed in column 2.

Corresponding range in column 3 is the minimum range expressed in gradations on the rear sight that will give the required clearance. Both the exact and even figures to the nearest 25 meters above are given. When the friendly troops you desire to fire over are visible, the safety angle can be measured by setting the corresponding range (use even figures).

Example: Friendly troops are visible. They are at a distance of 700 meters from the gun. The gun is laid to hit the target. Without disturbing the lay of the gun, the rear sight is set at 1225 meters. Before it is safe to fire, the line of aim must clear the troops.

Table II

Overhead Fire

Cartridge, Ball, M59				FT 7.62
Troop distance	Minimum angle of elevation	Difference	Exact figure	Even figure (to nearest 25 above)
meters	mils	mils	meters	meters
100	77		2006	2025
200	40.6	-36.4	1515	1525
300	29.5	-11.1	1314	1325
400	25.1	-4.4	1222	1225
500	23.3	-1.8	1182	1200
600	23.2	-0.1	1178	1200
700	25	1.8	1220	1225
800	27.9	2.9	1280	1300
900	31.5	3.6	1351	1375
1000	35.8	4.3	1432	1450
1100	41.2	5.4	1524	1525
1200	47.1	5.9	1618	1625
1300	53.9	6.8	1718	1725
1400	61.6	7.7	1821	1825
1500	70	8.4	1926	1950
1600	79.6	9.6	2034	2050
1700	90	10.4	2141	2150
1800	101.9	11.9	2252	2275
1900	114.7	12.8	2361	2375
2000	128.8	14.1	2472	2475
2100	144.2	15.4	2582	2600
2200	161.6	17.4	2694	2700
2300	181.3	19.7	2807	2825
2900	203.7	22.4	2921	2925
2500	228.5	24.8	3033	3050
2600	256.9	28.4	3147	3150
2700	289.2	32.3	3259	3275
2800	328	38.8	3373	3375
2900	375.5	47.5	3487	3500
3000	438.4	62.9	3601	3625

Table III

Mask Clearance - How to Use

Mask distance in column 1 is the distance in meters from the gun to the highest point of the mask. The minimum quadrant elevation that will clear a mask is such that the lowest shot in the cone will just graze the highest point on the mask. Such a quadrant elevation is comprised of the following factors:

- Angle of clearance (corresponding to mask distance)
- Angle of elevation (corresponding to mask distance)
- Angle of site to mask

The angle of clearance is based on the lower one-half of the vertical dimension of the cone. The angle of clearance plus the angle of elevation constitute the ***minimum angle of elevation*** that will afford clearance at any given mask distance.

Minimum angles of elevation are listed in column 2. If the quadrant elevation to the target equals or exceeds the minimum quadrant elevation, clearance exists.

Corresponding range in column 3 is the mil angle of required mask clearance expressed in gradations on the rear sight. When the mask is visible, the required mask clearance can be measured by setting the corresponding range on the rear sight.

Example: The mask is visible and is at a distance of 700 meters from the gun. The gun is laid to hit the target. Without disturbing the lay of the gun, the rear sight is set at 810. If the ***line of aim*** clears the mask, it is practicable to fire.

Table III

Mask Clearance

1	2		3		
Mask Distance	Minimum Angle of Elevation		Difference	Corresponding Range	
Meters	Exact figure	Mils	Mils	Meters	Round UP (nearest 10 meters)
100	2.41	3	1	289	290
200	3.37	4	1	370	370
300	4.47	5	1	454	460
400	5.57	6	1	538	540
500	6.7	7	1	625	630
600	8.67	8	1	717	720
700	8.56	9	1	810	810
800	12.94	13	4	896	900
900	15.76	16	3	986	990
1000	19.23	20	4	1082	1090
1100	22.71	23	3	1176	1180
1200	27.57	28	5	1274	1280
1300	32.44	33	5	1370	1370
1400	37.7	38	5	1465	1470
1500	43.54	44	6	1562	1570
1600	49.78	50	6	1658	1660
1700	56.68	57	7	1756	1760
1800	64.08	65	8	1853	1860
1900	72.35	73	8	1953	1960
2000	81.47	82	9	2054	2060
2100	91.56	92	10	2156	2160
2200	102.8	103	11	2260	2260
2300	114.8	115	12	2362	2370
2400	127.91	128	13	2465	2470
2500	142.36	143	15	2569	2570
2600	158.41	159	16	2674	2680
2700	176.44	177	18	2779	2780
2800	196.11	197	20	2884	2890
2900	218.46	219	22	2990	2990
3000	242.49	243	24	3092	3100

Table IVa

Target Above Gun - How to Use

This table combines the angle of sight with the angle of elevation when the target is above the gun and gives directly the quadrant of elevation in mils. For ranges not in even hundreds and for vertical intervals (VIs) not tabulated, the elevation must be determined by interpolation.

Example: The range to the target is 1200 meters. The VI is +30 meters. Using this information, locate the square in the "1200" column that intersects with the "30" row (located under "VI"). You can see that the quadrant elevation is 50.4 mils.

Quadrant Elevation in Mils, Knowing Range, and Vertical Interval in Meters--Target Above the Gun

VI meters	Horizontal distance from the gun in meters														
	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
100	800.7	473.9	330.4	253.4	206.4	175.2	153.5	138.2	127.2	119.5	114.2	110.9	109.2	108.9	109.8
95	774.6	453.3	315	241.4	196.5	166.9	146.4	131.9	121.6	114.4	109.5	106.6	105.2	105.2	106.3
90	747.2	432.3	299.5	229.3	186.7	158.6	139.2	125.6	115.9	109.3	104.9	102.3	101.3	101.5	102.9
85	718.3	411	283.9	217.1	176.8	150.3	132	119.3	110.3	104.2	100.2	98	97.3	97.8	99.4
80	688	389.2	268.1	204.9	166.9	141.9	124.8	112.9	104.6	99	95.5	93.7	93.3	94.1	95.9
75	656.2	367.1	252.2	192.6	156.9	133.6	117.6	106.6	99	93.9	90.9	89.4	89.3	90.3	92.4
70	622.8	344.6	236.1	180.3	146.9	125.2	110.4	100.2	93.3	88.8	86.2	85.1	85.3	86.6	88.9
65	587.8	321.7	220	167.9	136.9	116.8	103.1	93.9	87.6	83.7	81.5	80.8	81.3	82.9	85.4
60	551.2	298.5	203.7	155.5	126.8	108.3	95.9	87.5	81.9	78.5	76.8	76.4	77.3	79.1	81.9
55	512.9	275	187.3	143	116.8	99.9	88.6	81.1	76.2	73.4	72.1	72.1	73.3	75.4	78.4
50	473	251.1	170.8	130.5	106.7	91.5	81.4	74.7	70.5	68.2	67.4	67.8	69.2	71.6	74.9
45	431.4	227	154.3	117.9	96.6	83	74.1	68.3	64.8	63	62.7	63.4	65.2	67.9	71.4
40	388.3	202.7	137.6	105.3	86.5	74.5	66.8	62	69.1	57.9	57.9	59.1	61.2	64.1	67.8
35	343.7	178.1	120.9	92.7	76.3	66.1	59.5	55.5	53.4	52.7	53.2	54.7	57.1	60.3	64.3
30	297.6	153.3	104.1	80	66.1	57.6	52.2	49.1	47.6	47.5	48.5	50.4	53.1	56.6	60.8
25	250.3	128.3	87.3	67.3	56	49.1	44.9	42.7	41.9	42.3	43.7	46	49	52.8	57.2
20	201.8	103.1	70.4	54.6	45.8	40.8	37.6	36.2	36.1	37.1	39	41.6	45	49	53.7
15	152.4	77.8	53.5	41.9	35.6	32	30.2	29.8	30.4	31.9	34.2	37.2	40.9	45.2	50.1
10	102.2	152.5	36.5	29.1	25.4	23.5	22.9	23.3	24.6	26.7	29.4	22.8	36.8	41.4	46.5
5	51.6	27	19.5	16.4	15.2	15	15.6	16.8	18.8	21.5	24.7	28.4	32.7	37.6	43

Table IVb

Target Below Gun - How To Use

This table combines the angle of site with the angle of elevation when the target is below the gun and gives directly to quadrant elevation in mils. For ranges not in even hundreds, and for VIs not tabulated, the elevation must be determined by interpolation.

Example: The range to the target is 1200 meters. The VI is -30 meters (target below the gun). Look at the square where the "1200" column and the "30" row (under "VI") intersect. You can see that the quadrant elevation is -2.6 mils.

Quadrant Elevation in Mils, Knowing Range, and Vertical Interval in Meters - Target Below Gun

VI meters	Horizontal distance from the gun in meters														
	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500
-5	-50.1	-23.8	-14.4	-9	-5.2	-2	0.9	3.9	7.3	11	15.1	19.6	24.6	30	35.8
-10	-100.8	-49.2	-31.3	-21.7	-15.4	-10.5	-6.3	-2.4	1.5	5.7	10.3	15.2	20.4	26.1	52.2
-15	-150.9	-74.6	-48.3	-34.7	-25.5	-19	-13.6	-8.8	-4.2	0.4	5.4	10.7	16.3	22.3	28.6
-20	-200.3	-99.9	-65.2	-47.2	-35.7	-27.5	-20.9	-15.2	-9.9	-4.7	0.6	6.3	12.2	18.4	25
-25	-248.8	-125	-82.1	-59.9	-45.9	-35.9	-28.1	-21.5	-15.5	-9.8	-4.1	1.8	8	14.5	21.4
-30	-296.1	-150	-98.9	-72.5	-56	-44.4	-35.4	-27.9	-21.2	-14.9	-8.7	-2.6	3.9	10.6	17.7
-35	-342.2	-174.8	-115.7	-85.2	-66.2	-52.9	-42.7	-35.2	-26.8	-19.9	-13.9	-6.8	-0.3	6.7	14.1
-40	-386.8	-199.4	-132.4	-97.8	-76.3	-61.3	-49.9	-40.6	-32.5	-25	-17.9	-11	-4.2	2.8	10.4
-45	-429.9	-223.8	-149	-110.4	-86.5	-69.8	-57.2	-46.9	-38.1	-30.1	-22.5	-15.3	-8.1	-1	6.7
-50	-471.5	-247.9	-165.6	-122.9	-96.5	-78.2	-64.4	-53.3	-43.8	-35.2	-27.2	-19.5	-12.1	-4.7	3
-55	-511.4	-271.7	-182.1	-135.5	-106.6	-86.6	-71.6	-59.6	-49.4	-40.3	-31.8	-23.7	-16	-8.3	-0.7
-60	-549.7	-295.2	-198.4	-147.9	-116.6	-95	-78.9	-65.9	-55	-45.3	-36.4	-28	-19.9	-11.9	-4
-65	-586.3	-318.4	-214.7	-160.3	-126.7	-103.4	-86.1	-72.3	-60.7	-50.4	-41	-32.3	-23.8	-15.5	-7.4
-70	-621.3	-341.3	-230.9	-172.7	-136.7	-111.8	-93.9	-78.6	-66.3	-55.5	-45.6	-36.4	-27.7	-19.2	-10.8
-75	-654.7	-363.8	-246.9	-185.1	-146.6	-120.2	-100.5	-84.9	-71.9	-60.5	-50.2	-40.6	-31.6-	22.8	-14.2
-80	-686.5	-385.9	-262.8	-197.3	-156.6	-128.5	-107.6	-91.2	-77.5	-65.6	-54.8	-44.9	-35.5	-26.4	-17.6
-85	-716.8	-407	-278.6	-209.5	-166.5	-136.8	-114.8	-97.5	-83.2	-70.6	-59.4	-49.1	-39.4	-30	-20.9
-90	-745.6	-429	-294.2	-221.7	-176.4	-145.1	-122	-103.8	-88.7	-75.7	-64	-53.3	-43.2	-33.6	-24.3
-95	-773.1	-450	-309.8	-433.8	-186.2	-153.4	-129.1	-110	-94.3	-80.7	-68.6	-57.5	-47.1	-37.3	-27.7
-100	-799	-470.6	-325.1	-245.8	-196	-161.7	-136.3	-116.3	-99.9	-85.7	-73.2	-61.7	-51	-40.9	-31.1

Table V

Ordinates in Meters - How to Use

The figures indicate the height in meters of the center of the cone above the line of site at any distance from the gun. The negative figures indicate the distance of the center of the cone below the line of site at any distance from the gun.

Example: The range is 900 meters and the distance of 700 meters from the gun. Using this information, locate the square in the "900" column that intersects with the "700" row (located under "VI"). You can see that the center of the cone is 3 meters above the line of site.

Table V - Part 1

Ordinates in Meters

Cartridge, Ball, M59																FT 7.62	
Horizontal distance from the gun - meters																	
Range (meters)	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500	1600	Range (meters)
0	0	0	0	-1	-2	-4	-6	-9	-12	-16	-21	-27	-35	-44	-54	-66	0
100	0	0	0	-1	-2	-3	-5	-8	-11	-15	-20	-26	-34	-43	-53	-65	100
200	0	0	0	-1	-2	-3	-5	-7	-10	-14	-19	-25	-33	-42	-52	-64	200
300	0	0	0	0	-1	-2	-4	-6	-9	-13	-18	-24	-32	-41	-51	-63	300
400	0	0	0	0	0	-1	-3	-5	-8	-12	-17	-23	-30	-39	-49	-61	400
500	1	1	1	1	0	-1	-2	-4	-7	-11	-16	-22	-29	-38	-48	-60	500
600	1	1	1	1	1	0	-1	-3	-6	-9	-14	-20	-27	-36	-46	-58	600
700	1	2	2	2	2	1	0	-2	-4	-7	-11	-17	-25	-34	-44	-55	700
800	1	2	3	3	3	2	1	0	-2	-5	-9	-15	-22	-31	-41	-52	800
900	2	3	4	4	4	4	3	2	0	-3	-7	-12	-19	-27	-37	-48	900
1000	2	4	5	6	6	6	5	4	2	0	-4	-9	-15	-23	-32	-43	1000
1100	2	4	6	7	8	8	8	7	5	3	0	-5	-11	-18	-27	-37	1100
1200	3	5	7	9	10	11	11	10	9	7	4	0	-6	-13	-21	-31	1200
1300	3	6	9	11	13	14	14	14	13	12	9	5	0	-7	-15	-25	1300
1400	4	7	10	13	15	17	18	18	18	17	15	11	6	0	-8	-18	1400
1500	4	8	12	15	18	20	22	23	24	23	21	18	13	7	0	-9	1500
1600	5	10	14	18	21	24	26	28	29	29	28	25	21	16	9	0	1600
1700	6	11	16	20	24	27	30	33	35	36	35	33	30	25	18	10	1700
1800	6	12	18	23	27	31	35	38	41	42	42	41	39	35	29	21	1800
1900	7	14	20	26	31	36	40	44	47	49	50	50	48	45	40	33	1900
2000	8	16	23	29	35	40	45	50	54	57	59	60	59	56	52	46	2000
2100	9	18	26	33	39	45	51	57	62	66	69	71	71	69	65	60	2100
2200	10	20	29	37	44	51	58	65	71	76	80	83	84	83	80	76	2200
2300	11	22	32	41	50	58	66	74	81	87	92	96	95	98	96	93	2300
2400	12	2	35	46	56	66	75	84	92	99	105	110	113	114	113	111	2400
2500	14	427	39	51	63	74	85	95	104	112	119	125	129	131	132	131	2500
2600	15	30	44	57	70	83	95	106	117	126	134	141	147	151	153	153	2600
2700	17	33	49	64	78	92	106	119	131	142	152	160	167	172	176	178	2700
2800	18	36	54	71	87	103	118	133	147	160	171	181	189	196	201	205	2800
2900	20	40	60	79	97	115	132	149	165	179	192	204	214	222	229	234	2900
3000	22	44	66	87	108	128	147	166	184	200	215	229	241	251	260	267	3000
3100	25	49	73	97	120	142	164	185	205	224	241	257	271	284	295	304	3100
3200	28	55	82	108	134	159	183	207	230	251	271	289	306	322	336	347	3200
3300	31	62	92	121	150	178	206	233	259	283	306	327	347	366	383	397	3300
3400	35	70	104	137	169	201	233	264	293	321	348	373	397	419	439	457	3400
3500	41	80	119	157	194	231	267	302	336	369	401	431	459	485	509	531	3500
3600	48	94	139	184	228	271	313	354	394	433	471	507	541	573	602	628	3600
3700	57	115	172	228	284	339	393	446	497	547	595	641	685	726	764	799	3700

APPENDIX C

Gunnery Terminology

Angle of elevation (AE). The angle formed by the line of site and the axis of the bore.

Angle of site (AS). The angle formed by the line of site and a horizontal line through the chamber of the gun.

Beaten zone. The area on the ground upon which the cone of fire falls.

Center of impact. The center of the beaten zone.

Cone of fire. The group of trajectories from a burst of fire. The trajectories of a burst vary due to gun vibration, variations in ammunition, and atmospheric conditions.

Corresponding range. The range from the gun to the point of the strike when the gun is fired with the required safety angle over the heads of friendly troops.

Danger space. The space between the gun and the target in which the trajectory does not rise above the height of the average man.

Dead space. A portion of the final protective line that cannot be covered by grazing fire.

Enfilade fire. Fire in which the long axis of the beaten zone coincides with the long axis of the target.

Final protective line (FPL). A predetermined line of grazing machinegun fire designed to break up an enemy assault.

Fire commands. Instructions issued to enable a gun crew to engage a target.

Fixed fire. Fire delivered on a point target.

Flanking fire. Fire delivered against the flank of a target.

Free gun. Fire used against moving targets; requires quick changes in elevation and deflection.

Frontal fire. Fire delivered at right angles to the front of a target.

Grazing fire. Fire approximately parallel to the ground where the center of the cone of fire does not rise above 1 meter above the ground.

Gunner's rule. Rule used to determine the safety angle when the range to the target is 900 meters or less.

Leader's rule. Rule used to determine the safety angle when the range to the target is greater than 900 meters.

Line of site. A straight line from the chamber of the gun to the target.

Mil. The angle that subtends an arc of 1 unit at a distance of 1000 units.

Minimum clearance. Mimimum clearance when the center of the cone of fire must clear the heads of friendly troops by a prescribed distance.

Oblique fire. Fire delivered so that the long axis of the beaten zone forms an angle with the long axis of the target.

Ordinate. The height of the trajectory at any given point.

Maximum ordinate. The highest point on the trajectory.

Plunging fire. Fire in which the angle of fall of the bullets with reference to the slope of the ground is such that the danger space is practically confined to the beaten zone.

Position defilade. A machinegun is in position when the gun and crew are hidden from enemy ground observation and direct small arms fire from the target area by a crest or mask, however an observer standing at or near the gun can see the target and adjust fire.

Quadrant elevation (QE). The angle is formed by the line extending through the axis of the bore toward the target and the horizontal line through the gun.

Safety angle. The minimum permissible angular clearance at the gun of the path of a projectile above friendly troops. It is the angle of clearance corrected to insure the safety of the troops.

Searching fire. Fire distributed in depth by successive changes in the elevation of a gun.

Swinging traverse. Fire delivered against moving targets when you desire fairly rapid changes in direction, minor changes in elevation, and continuous firm control of the gun.

Trajectory. The path of the projectile through the air after the propulsive force terminates.

Traversing fire. Fire distributed in width by successive changes in the direction of the gun.

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